PROJECT MANAGER AND TEST AND EVALUATION FACILITY RELATIONSHIP

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THESIS

PROJECT MANAGER AND TEST AND EVALUATION
FACILITY RELATIONSHIP

by

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September 1975

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This thesis investigates the relationship between Washington based Project Managers and a Test and Evaluation (T&E) facility, the Pacific Missile Test Center (PMTC). Five areas of the relationship are examined. First, the formal weapon system acquisition process as prescribed by current directives is presented as an overview. Next, the Pacific Missile Test Center organization is analyzed. This is followed by an investigation

of funding techniques, and specifically, those employed by PMTC. The Project Managers' perception of their participation in the T&E process is presented through results of a questionnaire. Finally, an objective method of selecting the appropriate T&E facility for a project based on technical capability is developed.

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ABSTRACT

This thesis investigates the relationship between Washington based Project Managers and a Test and Evaluation (T&E) facility, the Pacific Missile Test Center (PMTC). Five areas of the relationship are examined. First, the formal weapon system acquisition process as prescribed by current directives is presented as an overview. Next, the Pacific Missile Test Center organization is analyzed. This is followed by an investigation of funding techniques, and specifically, those employed by PMTC. The Project Managers' perception of their participation in the T&E process is presented through results of a questionnaire. Finally, an objective method of selecting the appropriate T&E facility for a project based on technical capability is developed.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACP	Area Coordinating Paper
ADTC	Armament Development and Test Center
AEDO	Aeronautical Engineering Duty Officer
AFWR	Atlantic Fleet Weapons Range
AIR( )	Office within NAVAIR Headquarters
AIRTASK	Tasking form from NAVAIR to field activities
AMD	Aircraft Maintenance Department
ARC	Acquisition Review Committee
ASC	Advanced System Concept
ASN(R&D)	Assistant Secretary of the Navy (Research and Development
BIS	Board of Inspection and Survey
CEB	CNO Executive Board
CND	Chief of Naval Development
CNM	Chief of Naval Material
CNO	Chief of Naval Operations
CNR	Chief of Naval Research
COMPMR	Commander Pacific Missile Range
DA	Developing Agency
DCNM ( )	Deputy Chief of Naval Material for ( )
DCNO ( )	Deputy Chief of Naval Operations for ( )
DCP	Development Concept Paper

DDPA&E	Director of Defense Program Analysis and Evaluation
DDR&E	Director, Defense Research and Engineering
DDT&E	Deputy Director, Test and Evaluation
DLP	Director of Laboratory Programs
DNL	Director of Navy Laboratories
DoD	Department of Defense
DoDDIR	DoD Directive
DP	Development Proposal
DRDT&E	Director RDT&E (OP-098)
DSARC	Defense Systems Aquisition Review Council
DT&E	Development Test and Evaluation
ESTR	Eastern Test Range
ILS	Integrated Logistic Support
IOT&E	Initial Operational Test and Evaluation
JCS	Joint Chiefs of Staff
LTM	Less-Than-Major Project
LRLTM	Lower Range Less-Than-Major Project
MAT ( )	Office within NAVMAT
MCP	Mission Coordinating Paper
MIS	Management Information System
MRTFB	Major Ranges and Test Facilities Base
NAC	Navy Advanced Concepts
NAF	Naval Air Facility

NAMTC	Naval Missile Test Center
NAPTC	Naval Air Propulsion Test Center
NATC	Naval Air Test Center
NAVAIR	Naval Air Systems Command Headquarters
NAVAIRINST	NAVAIR Instruction
NAVMAT	Headquarters Naval Material Command
NAVMATINST	NAVMAT Instruction
NDCP	Navy Development Concept Paper
NIF	Navy Industrial Fund
NMC	Naval Material Command
NMC	Naval Missile Center
NNAP	NAVAIR Naval Aviation Plan
NPE	Naval Preliminary Evaluation
NRL	Naval Research Laboratory
NTE	Naval Technical Evaluation
NWC	Naval Weapon Center
NWTC	Naval Weapons Test Center
OPEVAL	Operational Evaluation
OPNAV	Office of the CNO
OPTEVFOR	Operational Test & Evaluation Force
OR	Operational Requirement
OSD	Office of the Secretary of Defense
OT&E	Operational Test and Evaluation
PDA	Principle Development Agency

PDM	Program Decision Memorandum
PM	Project Manager
PM	Program Memorandum
POM	Program Objectives Memorandum
PMP	Program Master Plan
PMR	Pacific Missile Range
PMTC	Pacific Missile Test Center
R&D	Research and Development
RDT&E	Research, Development, Test, and Evaluation
RTF	Reimbursable Institutional Funding
RIF	Reduction in Forces
RMA	Range Management Agency
RMS	Resource Management System
SAMTC	Space and Missile Test Center
SECDEF	Secretary of Defense
SECNAV	Secretary of the Navy
SECNAVINST	SECNAV Instruction
SER	Shore Establishment Realignment
SPSS	Statistical Package for the Social Sciences
T&E	Test and Evaluation
TAP	Task Area Plan
TCP	Technology Coordinating Paper
TECHEVAL	Technical Evaluation
TECO	Test and Evaluation Coordinating Officer

TEMP	Test and Evaluation Master Plan
SPSS	Statistical Package for the Social Sciences
WSAM	Weapon Systems Acquisition Mangement
WSMR	White Sands Missile Range

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I. INTRODUCTION

The authors' previous educational background in Aeronautical Engineering combined with their current education in Administrative Sciences stimulated interest in the Weapons System Acquisition Management (WSAM) field. It was hoped that thesis research in this area would benefit the authors in future billet assignments in this area. In order to focus on a specific topic, a literature search of current research in this area was conducted. The search indicated a number of interesting problems involving the Test and Evaluation (T&E) aspects of WSAM. It was considered desirable to concentrate on the focal point of T&E, namely, the Washington D.C. arena. However, due to lack of funding support, trips to the Washington area were considered impractical. Consequently, problems involving T&E activities in the local region were investigated. Contacts were made at both the Naval Weapon Center (NWC), China Lake, and the Pacific Missile Test Center (PMTC), Point Mugu.

A trip was made to point Mugu for familarization and problem definition purposes. Personnel at Point Mugu were very receptive and interested in cooperating with thesis research involving PMTC. After the initial trip, it was decided to concentrate on analyzing the T&E facility/Project Manager relationship. Additional trips made to Point Mugu focused on understanding the activity's involvement in the T&E process.

The next five chapters represent the results of this research with the first four chapters concentrating each on a separate aspect of the relationship. First, the formal weapon system acquisition process (principly the T&E aspects) as prescribed by current directives is presented for purposes of providing an overview of how the process

should work. Next, a T&E activity's (PMTC) organizational development is described together with how the organization interacts with its external environment. Presupposing that "he who has the gold rules", the financial management of the facility is investigated. This is followed by a different viewpoint of the relationship: the Project Manager's perception of his participation in the T&E process. The Project Manager's opinions were ascertained by means of a questionnaire. Results of the questionnaire provide the data for Chapter VI. This chapter proposes an objective method of selecting the appropriate T&E facility for a particular weapon system's T&E requirements based on technical capabilities.

II. TEST AND EVALUATION WITHIN THE NAVY

A. ORGANIZATION FOR RDT&E

Reference 1 provides a general overview of the Navy RDT&E organization and process. Much of the following information has been extracted from it in order to briefly acquaint the reader with pertinent background information.

In the National Security Act of 1947 Congress tasked the Secretary of Defense to :

"...eliminate unnecessary duplication in the Department of Defense and particularly in the field of research and engineering..."

Later, the Defense Reorganization Act of 1958 established the Director of Defense Research and Engineering (DDR&E) as the highest ranking assistant secretary of defense. The primary responsibilities of DDR&E are to act as principal advisor to the Secretary of Defense (SECDEF) on scientific and technical matters, supervise research and engineering, and direct and control research and engineering activities. To fulfill his responsibilities he has been delegated authority to approve, modify, or disapprove programs and projects of the Military Departments. DODDIR 5100.1 (Ref. 2) established the Deputy Director(Research and Advanced Technology)(R&AT) and the Deputy Director(Test and Evaluation) (DDT&E) as advisors to the Director.

In addition to the above DOD organization, the Joint Chiefs of Staff (JCS) has the responsibility of advising SECDEF on matters of strategic guidance, overall military requirements, and recommendations of new weapon systems.

Figure 1 depicts the Department of the Navy Organization for RDT&E. While the overall responsibility for policies and control of the Department of the Navy rests with the Secretary of the Navy. Matters related to research, development, engineering, test and evaluation are the specific responsibility of the Assistant Secretary of the Navy (R&D)(ASN(R&D)) as directed by SECNAVINST 5430.67 (Ref. 3). He and his small staff act as the principal contact for DDR&E and manage the "Research, Development, Test and Evaluation, Navy" appropriations account. Due to his limited staff size he is dependent on advisors such as Director RDT&E (OP-098), the Chief of Naval Development (CND), Chief of Naval Research (CNR), and the Director of Navy Laboratories (DNL).

The Office of the Chief of Naval Operations is primarily concerned with defining potentially attainable capabilities, appraising the military worth of RDT&E advancements, and approving projects which promise the greatest return on invested resources. These policies are specifically implemented by DRDT&E (OP-098) who acts as the focal point for T&E policy.

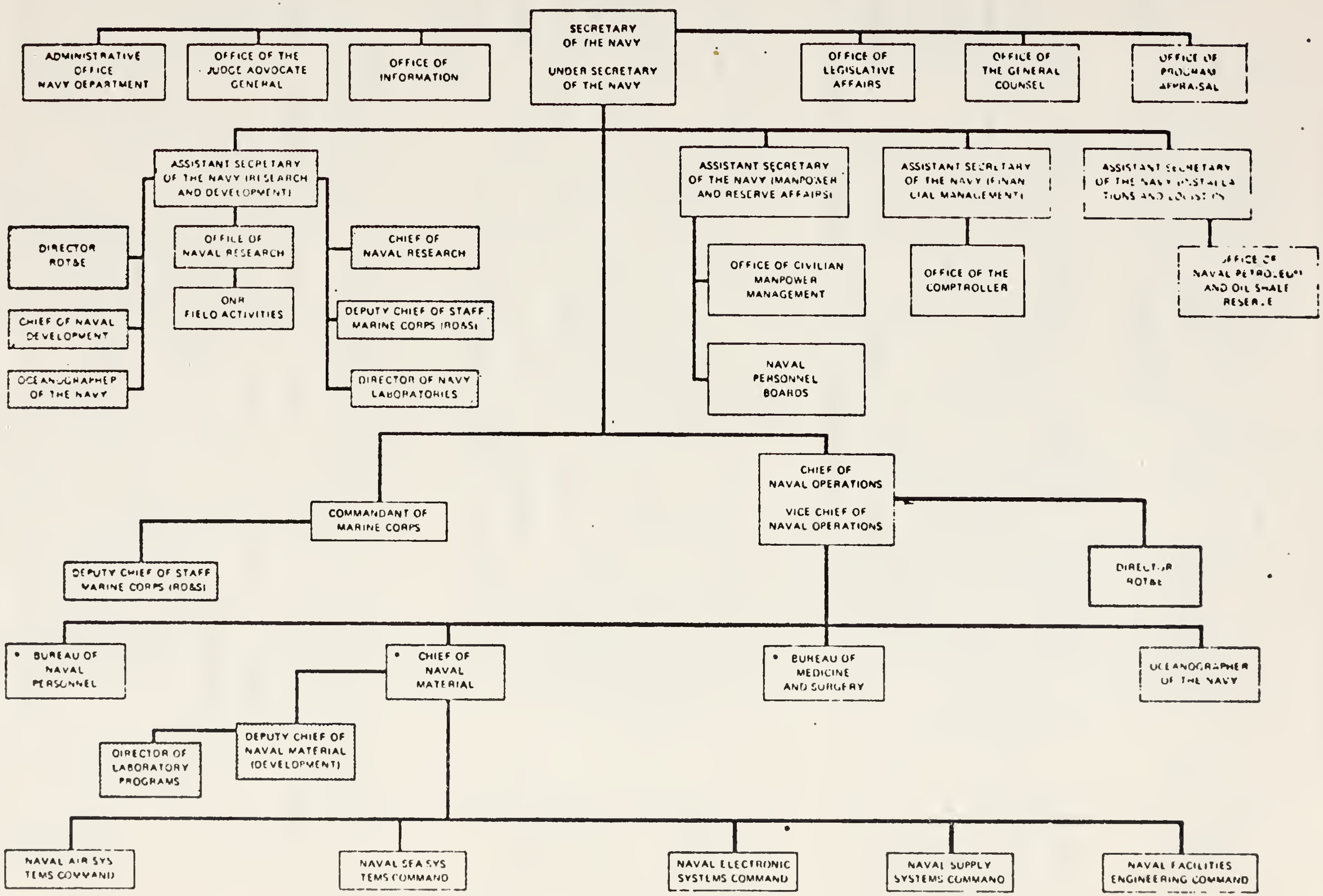
The "how" aspects of Navy RDT&E have been delegated to the Chief of Naval Material (CNM). His responsibilities include:

1. Translating operational requirements into hardware systems and technology objectives.

2. Managing the technology base.

3. Defining science and technology capabilities.

4. Developing detailed plans for RDT&E projects.



*NOTE Also responsive directly to CMC for Marine Corps needs

FIGURE 1. DEPARTMENT OF THE NAVY ORGANIZATION FOR RDT&E

5. Overseeing implementation of RDT&E programs.

CNM is assisted in the implementation of the above by the Deputy Chief of Naval Material(Development) (DCNM(D)) who also acts as Chief of Naval Development (CND) and reports directly to ASN(R&D).

The Naval Material Command consists of NAVMAT designated Project Managers (PMs) plus the various Systems Commands as depicted in Figure 2. NAVMAT designated PMs are utilized for projects with critical interfaces between Military Services and/or Systems Commands. For other projects, one of the Systems Commands is placed in charge and Projects Managers are designated within it.

NAVAIRINST 5451.80 (Ref. 4) established the Project Management Office(AIR) within NAVAIR Headquarters to assist in the planning, directing, and controlling general management aspects of specific weapons system projects. As such, they are responsible for maintaining the NAVAIR designated project charters (5430 instruction series), communicating broad policy guidance to PMs from higher authority, and providing other assistance to PMs as required.

The project management organization is structured by purpose and thus cuts across various functional organization lines. PMs are generally Navy Captains or Flag Officers available for at least a three year tour. OPNAVINST 3960.8 (Ref. 5) charges the PM with the responsibility for coordination and execution of a T&E program responsive to the policies expressed in SECNAVINST 5000.1 (Ref. 6). Specifically, he must coordinate a test program with the CNO development coordinator suitable to answer operational questions, prepare a Test and Evaluation Master Plan (TEMP), arrange for the performance of T&E and T&E support at

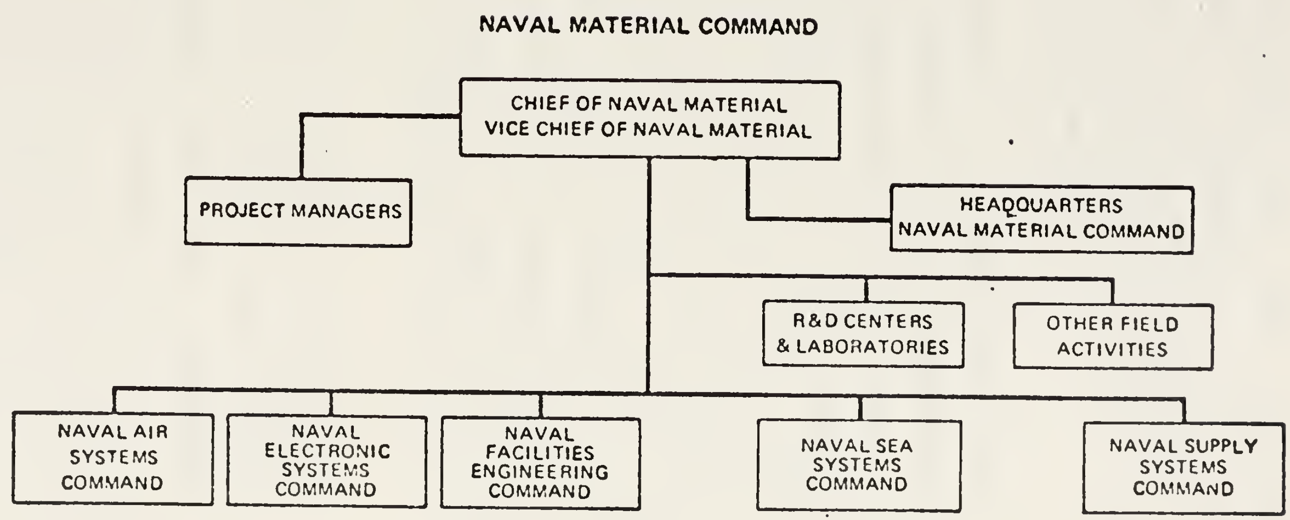


FIGURE 2. THE NAVAL MATERIAL COMMAND ORGANIZATION

appropriate laboratories, contractor facilities or T&E activities, and determine the need for assistance of operating forces.

Laboratories responsible for R&D of aircraft and missile systems report directly to the Director of Laboratory Programs (DLP) in the staff of DCNM(D). The DLP, also acting as DNL, is the principal advisor to ASN(R&D) in matters of the RDT&E field complex.

Test and Evaluation of aircraft and aircraft weapon systems is generally divided into Operational Test & Evaluation (OT&E) and Development Test & Evaluation (DT&E). OT&E is the responsibility of the VX squadrons of the Operational Test and Evaluation Forces (OPTEVFOR) which report to CNO via OP-983, the Test and Evaluation Division of OP-098. DT&E is generally under the cognizance of field activities such as the Naval Air Test Center and Pacific Missile Test Center which report to NAVAIR. The coordination of T&E activity within NAVAIR is currently delegated to the Test and Evaluation Coordinator (TECO) who is double-hatted as CO NATC as directed by NAVAIRINST 5400.27B (Ref. 7).

Some of the specific tasks of TECO are: provide to NAVAIR recommendations and proposed directives concerning T&E policy, act as focal point for T&E matters, assist in preparation of and evaluate planning documents containing T&E requirements, provide comments to NAVAIR on adequacy of T&E plans, review and evaluate workload assignment to field activities, monitor actual T&E accomplishment in order to recommend readjustment of available resources, provide planning information to field activities, and assist NAVAIR PMs in the coordination with COMOPTEVFOR.

NAVAIR NOTICE 5400 of 18 March, 1975 (Ref. 8) established the Assistant Commander for Test Evaluation

(AIR-06) and called for an AIR-06 operational status by 1 July 1975. He is responsible for the policy direction, planning, management and support of NAVAIRSYSCOM T&E programs, facilities, ranges, and targets. He is the primary NAVMAT contact with contractors and other government agencies for matters concerning T&E facilities, ranges, and targets including all Navy elements of the Department of Defense Major Ranges and Test Facilities Base. Specific duties include; assisting Project Managers in preparing for Defense Systems Acquisition Review Council (DSARC) reviews and in budget preparation, providing life-cycle management of targets and T&E support systems, providing guidelines for and approving mission functions, organization and staffing of T&E field activities and ranges, establishing the policy for the assignment of workload to the T&E field activities, establishing priorities for the use of T&E activities, and maintaining liaison with COMOPTEVFOR to assure a coordinated DT&E and OT&E of NAVAIR weapon systems and equipment. The presently anticipated organization within AIR-06 calls for an AIR-06T (double-hatted as CO NATC) who would be responsible for T&E efforts and AIR-06R (double-hatted as CO PMTC) who would be responsible for all ranges and targets.

B. PLANNING PROCESS

The planning system leading to OPNAV-supported RDT&E weapon systems has recently been revised from the old system in effect since 1961. This paper will address the new system; however, projects approved under the old system are still in development and remain under the documents produced by that system.

Figure 3 depicts the documentation and review procedure utilized throughout the planning phases of a project. Proposals of future concepts, called Advanced System

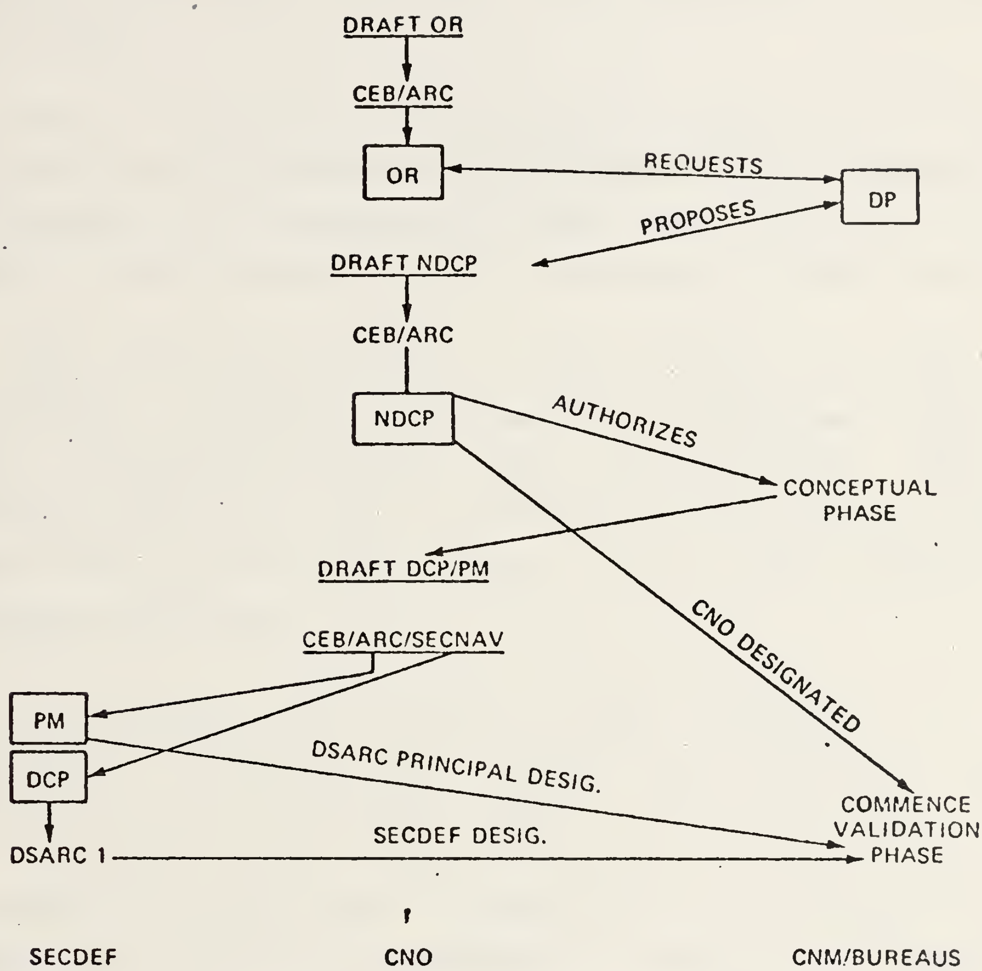


FIGURE 3. DOCUMENTATION AND REVIEW PROCEDURE

Concepts (ASC), are contained in the Navy Advanced Concepts (NAC). Up to 30 proposals may be submitted by each Systems Command and essentially bridge the gap between science and technology and a budgeted project. The Director of RDT&E within the Navy selects a number of these during the Navy budgeting cycle (POM Process) for initiation of Advanced Development.

Concise statements of operational needs for 0- 10 years are reflected in Operational Requirements (OR). These three page requests for proposal from CNM are originated within OPNAV at the request of Fleet activities or other commands.

After technical studies, CNM replies to OPNAV with alternative solutions contained in Development Proposals (DPs). OPNAVINST 5000.42 (Ref. 9) suggests that an iterative process should be developed between the OPNAV OR sponsor and the CNM to prepare the DP and resolve all relevant questions.

In response to the DP, OPNAV prepares a Navy Development Concept Paper (NDCP) for approval by the Acquisition Review Committee (ARC), a sub-committee of the CNO Executive Board (CEB). The NDCP represents the first commitment of OPNAV RDT&E resources. It includes issues, objectives, plans, parameters, areas of risk, and development alternatives, and provides the basis for a Development Concept Paper (DCP). The DCP, as stated in OPNAVINST 3930.8B (Ref. 10) is the basic source of advance evaluation planning information.

Although the DCP and DSARC process is utilized only for major programs, similar processes are used for minor programs. A major program is one having an estimated RDT&E cost in excess of $50 million, an estimated production cost greater than $200 million, or otherwise designated by

SECDEF. Most DCPs cover the decision the Secretary of Defense is being asked to make, the alternatives, the program justification, the program management plan, projected costs, risks, and the limits of the grant of authority from SECDEF (thresholds). The DCP is limited to 20 pages and is essentially a contract between SECDEF and the Navy. Programs designated by the Deputy Director of Research & Engineering or other appropriate principal of DSARC are similarly documented by Program Memorandum (PM). Each is developed through interaction of DDR&E, CNO, CNM and the Principal Developing Activity (PDA), which is a field installation.

The life cycle of a weapons system, as defined by DODDIR 5000.1 (Ref. 2) consists of 5 phases. They are: Conception, Validation, Full Scale Development, Production, and Deployment.

The Conception Phase, conducted at the discretion of the Department of the Navy, establishes a technological, military, and economic base for the program through analysis and experimentation. It culminates with the approval of an Advanced Systems Concept.

The Validation Phase, often identified with advanced development, consists of hardware development and extensive analysis of the concepts of Phase I. Ideally, it ends with a successful demonstration of a "brass board" model.

In the Full Scale Development Phase the weapon system and all support items are designed, fabricated, and tested. It includes T&E both on the part of the contractor and the Navy.

During the Production Phase, the weapon and all support items and spares are produced for operational use.

The final phase, Deployment, consists of providing the weapon system to operational units and its subsequent use by them.

In view of the above life cycle, the DCPs are aimed at major milestone decisions between phases. The first decision, DSARC I, comes after the Conceptualization Phase and is essentially a program initiation decision. DSARC IIA, initiation of Full Scale Development, confirms that the need for the system is current and that development risks have been identified and provided with solutions. The production decision may be either for a limited (pilot) production (DSARC IIB) or full scale production (DSARC III). The major elements of this decision are: the need is still current, a practical engineering design has been achieved, technical uncertainties are resolved, T&E has determined operational suitability, and the remainder of the program is realistic.

DSARC membership includes DDR&E, the Assistant Secretaries of Defense for Installations and Logistics and Comptroller, and the Director of Defense Program Analysis and Evaluation (DDPA&E). The Deputy Secretary of Defense and other ASDs may be included as required.

The DCP eventually forms the basis for the Project Manager's overall supervision of a specific project. The Test and Evaluation Master Plan must be carefully constructed to ensure that all key issues in the DCP are addressed and all questions are answered. Thus the DCP becomes an important document in determining where and how the T&E for the project will be conducted.

NAVMATINST 3960.6 (Ref. 11) states that the TEMP should be considered as a planning document rather than a control document. It contains objectives, issues, responsibilities, interfaces, and schedules. It attempts to identify test

activities and facilities intended to be used and tasks the PM with ensuring all necessary liaison and coordination with the test ranges and activities is accomplished to facilitate advance planning. The instruction requires the TEMP to be distributed to the CNO Program Coordinator (or OPNAV sponsor), OP-983, COMOPTEVFOR, CNM(MAT 03L,030,033,04H,04T), and participating Systems Commands and field activities. The provisions of this instruction apply to all major projects.

NAVAIRINST 3960.2 (Ref. 12) places the requirement for a TEMP on Less-Than-Major (LTM) Projects (less than $50 million RDT&E, less than $200 million production costs) and Lower-Range-Less-Than-Major (LRLTM) Projects (less than $5 million RDT&E, less than $20 million production costs). A simplified format is provided for LRLTM Projects.

Within NAVAIR, NAVAIRINST 5000.4A (Ref. 13) established an integrated NAVAIR Naval Aviation Plan (NNAP) for current, mid-range, and long-range planning within estimated fiscal constraints. The NNAP is designed to identify worthwhile new ideas early through a forecast of the state-of-the-art in critical sciences and identification of operational requirements. Specifically, it integrates aircraft, weapons and carrier planning data into a long range plan for aircraft and weapon development, procurement, and support. Additionally, it identifies critical advanced development, and provides the Navy with long range logistic and facility requirements. The inherent security classification of the NNAP renders it relatively ineffectual for use at the facility.

The Project Master Plan (PMP), developed by the Project Manager/Acquisition Manager, depicts the integration of all aspects of weapon system acquisition such as ILS (integrated logistic support), R&D, DT&E, OT&E, procurement and funding.

An AIRTASK is utilized within NAVAIR for assigning work to field activities. NAVAIRINST 3900.8 (Ref. 14) states that an AIRTASK is the document for translating the budget task into work assignments to be performed by a field activity. When feasible, it includes all necessary technical details to enable field activities to accomplish the work in accordance with NAVAIR requirements. A WORK UNIT ASSIGNMENT is a detailed assignment to a field activity for performance of a specific task within the scope of a previously assigned AIRTASK.

At the OSD level, in addition to the DCP/DSARC process, other types of R&D coordinating papers exist. They are: the Technology Coordinating Papers (TCP) which highlights service gaps, overlaps and needs in a given technological area. Area Coordinating Papers (ACP) which are similar to TCPs only cover warfare specialty areas, and Mission Coordinating Papers (MCP) which are an expansion on ACPs and analyze threat, needed technology, force implications, resource impact, and future options.

C. TEST AND EVALUATION

The major objective of T&E is to provide the best information available on the military utility of a prospective system, its operational effectiveness and operational suitability, needs for further development or modification, and data useful in estimating the probable cost of development completion, acquisition and ownership.

Basic policy, as stated in Reference 1, dictates evaluation by an independent organization so far as possible and evaluation of operational suitability prior to production. Both of these policies are primarily accomplished through the conductance of IOT&E by OPTEVFOR

and the conductance of acceptance trials by the Board of Inspection and Survey (BIS). These two groups report to the CNO for these functions. OPNAVINST 3960.8 (Ref. 5) recognizes the similarity of these 2 functions and calls for close coordination to prevent unnecessary duplication.

The mission of the Board of Inspection and Survey is, as stated in OPNAVINST 5420.70:

> "... to inspect new model aircraft for construction and suitability for the purpose intended and to make recommendations on their acceptance by the Navy ".

The Sub-Board of Inspection and Survey at Patuxent River is assigned the responsibility of conducting trials of aircraft to determine if the aircraft has been constructed in accordance with contract specifications. All materiel, performance and design defects and deficiencies found are reported by the Board along with recommended design changes.

T&E is integrated throughout the acquisition cycle and is not merely a follow-up to R&D. OSD classifies RDT&E into two categories: Development Test and Evaluation and Operational Test and Evaluation.

DODDIR 5000.3 defines DT&E as:

> "...test and evaluation conducted to:demonstrate that the engineering design and development process is complete; demonstrate that the design risks have been minimized; demonstrate that the system will meet specifications; and estimate the system's military utility when introduced."

DT&E includes Engineering Development and Design

Support Tests, Developing Agency (DA) Tests performed by OPTEVFOR, Contractor Demonstration, and Technical Evaluation (TECHEVAL). Included within the TECHEVAL is the Navy Preliminary Evaluation (NPE), an early assessment of mission potential prior to extensive tests, and the Navy Technical Evaluation (NTE), a test designed to determine a system's acceptability for fleet use. A TECHEVAL, as stated in OPNAVINST 3930.8B, is assigned by CNO in response to a favorable program full-scale development decision by the SECDEF or comparable CNO/CNM decision approving the commitment of resources for full-scale development. Additionally, a TECHEVAL may be requested by a Developing Activity to determine suitability for other acquisition programs and improvements such as conversions and modernizations.

NAVMATINST 3960.6 (Ref. 11) states that OPTEVFOR participation in DT&E is necessary to insure that meaningful and realistic tests from the fleet operational viewpoint are included in order to permit an early assessment of operational suitability.

OT&E is defined as:

> "...that test and evaluation conducted to estimate the prospective system's military utility, operational effectiveness, and operational suitability (including compatibility, interoperability, reliability, maintainability and logistic and training requirements), and need for any modifications. In addition, OT&E provides information on organization, personnel requirements, doctrine, and tactics."

An important subcategory of OT&E is Initial Operational Test and Evaluation (IOT&E) which according to DOD directive

must be accomplished prior to the first major production decision. IOT&E is conducted through an Operational Evaluation (OPEVAL), which is assigned by CNO at the time the TECHEVAL is assigned. The objectives of OPEVAL are to determine that the system meets program objectives under operational conditions, can be effectively operated and maintained by fleet personnel, logistic support is feasible, and all performance and suitability questions are adequately examined.

OPNAVINST 3930.8B (Ref. 10) defines the various priorities which will be assigned to projects by CNO. They are: AA-critical to the Navy's readiness for war, A-projects of an urgent nature bearing significantly on the Navy's readiness for war, and B-projects that are to be started and completed as soon as higher priority operations permit.

III. POINT MUGU'S ROLE IN TEST AND EVALUATION

This chapter follows the organizational development of a T&E activity, namely, the Pacific Missile Test Center, Point Mugu. Many of the organizational problems experienced at the Point Mugu complex are similar to those at other T&E activities, since they are all operating under the same environmental influences. A brief historical background of Point Mugu's past activities is presented. This is followed by a more detailed description of events that occurred during the past few years. Some of the problems affecting Point Mugu's operational effectiveness are discussed together with a description of the new reorganization, recently instituted at Point Mugu.

This chapter provides an appreciation for the difficulties encountered in managing the operations of a T&E installation and, hopefully, will provide a better perspective of the T&E evolution from the activities' viewpoint. It must be emphasized that many of the criticisms and problems mentioned are strictly the opinions of the authors. These opinions were derived from personal interviews conducted during trips made to the Point Mugu complex.

A. BACKGROUND

The Navy's post World War II interest in Point Mugu began in 1945 when a group of Navy engineers and technicians was located there to establish a Navy weapons development and test capability. Shortly thereafter, the Naval Missile Test Center (NAMTC) was established to carry out the Navy's weapons test requirements. In 1958, with growing emphasis on space programs, the range organizations of NAMTC were reorganized into the Pacific Missile Range and designated

one of the six National Ranges under the administration of Deputy Director, Test and Evaluation, DoD, with the Navy designated as its Range Management Agency (RMA), responsible for management and operation. Under the National Range concept, all DoD and other federal agencies obtained common range support services free, with the exceptions of services performed outside the normal working day or services that required extraordinary data reproduction (Ref. 15). The remainder of the NAMTC organization was consolidated into the Naval Missile Center, as a separate field activity of the then Bureau of Aeronautics. Both NMC and PMR were separate activities hosted aboard the Naval Air Station, Pt. Mugu, which was a subordinate command of the PMR. NMC maintained its role in weapons test functions utilizing the range services of the PMR which played an important role in satellite and space vehicle programs of the 60's.

As funding for the space program peaked out and with growing public concern over the the Vietnam conflict, emphasis at the PMR again shifted to weapons. NMC became the primary user of range services at PMR as test and evaluation took a significant role in weapons development. In 1970, NMC was designated as a subordinate command under the Commander of PMR (Ref. 16). PMR's command authority was only perfuncory as NMC struggled to maintain its identity as a separate command. In June 1974, NMC was again established as an echelon 4 activity (subordinate to Systems Commands), reporting directly to NAVAIRSYSCOM and hence bypassing COMPMR in the chain of command. NMC's separate command identity was shortlived, however, as COMPMR successfully convinced NAVAIRSYSCOM that the Pt. Mugu complex would be more effective if the resources of NMC and PMR were reorganized into a separate command activity, the Pacific Missilie Test Center (PMTC).

B. NMC'S INVOLVEMENT

In 1958, with the establishment of PMR as a National Range, NMC began to expand its capabilities as a weapons test facility which entailed functions already available at PMR. By 1970, NMC was capable of providing total weapons testing services with the exception of the range resources needed for actual launches (i.e. launch pads and range terrain). The services at NMC included the planning and conducting of engineering experiments for determining the operational effectiveness and reliability of assigned weapons systems as well as the laboratory investigations concerning the development, test, and evaluation of weapon systems. Other functions, however, not normally performed by a weapons testing facility had also been developed. The Aircraft Maintenance Department accomplished intermediate level maintenance on the growing fleet of aircraft assigned to NMC. The Photo/Graphics Department had developed photographic facilities which constituted one of the best-equipped laboratories in the Navy. The Threat Simulation Department had developed expertise in the design, development, procurement and operation of aerial, seaborne, land and special targets.

C. CONSOLIDATION

By 1970 PMR's space program involvement was all but eliminated by the increasing emphasis on weapons testing. For purposes of reducing duplicative functions of PMR and NMC both activities were placed under one commander along with the Naval Air Station and the PMR Facility, Hawaiian Area (Figure 4). NMC would provide photographic and aircraft maintenance services for tenant activities and provide target development and operation support for the PMR Directorate.

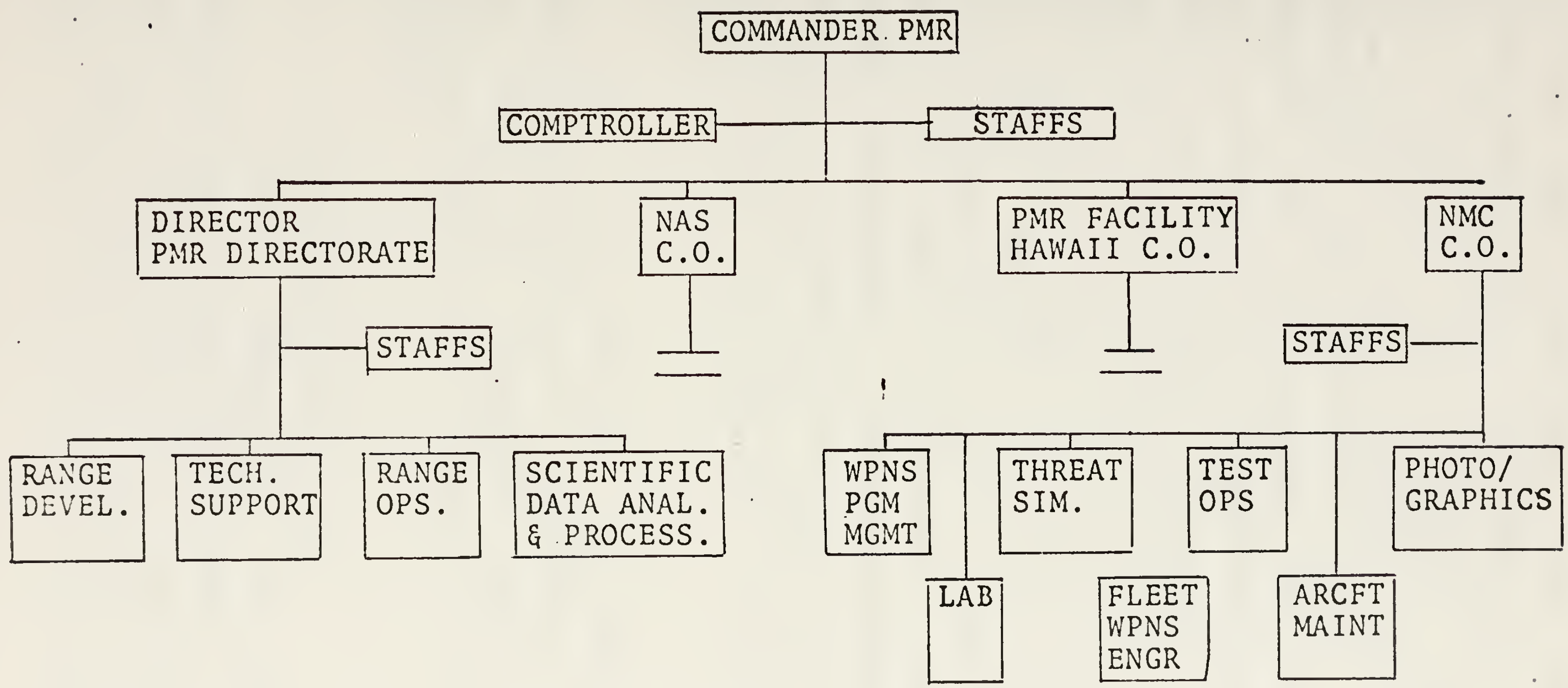


FIGURE 4
PMR ORGANIZATION

PMR, as a prime supporter of the space program had found little difficulty obtaining funding for range expansion and improvement. PMR's institutional funding flowed directly from the DoD level and resource allocation was loosely controlled. As a member of the National Ranges, PMR's facilities were available "free-of-charge" and, consequently, little motivation was provided to improve efficiency. Many observers at the Pt. Mugu complex have described PMR as a stagnant organization. One individual who was attached to the range organization of NAMTC back in the 50's and had recently rejoined the organization stated " The range is still conducting business the way it did 20 years ago." NMC, on the other hand, was receiving much of its funding through Navy weapon systems appropriation categories. Tighter control of resources through the Navy chain-of-command had a positive effect on NMC's efficiency since NMC enjoyed a favorable reputation as a well-run, dynamic organization. Command assignment to NMC was highly desirable and almost an assurance for promotion. Assignment to command of PMR was not viewed in the same light as, traditionally, the commander of PMR was on his "twilight tour".

With the exception of eliminating a number of duplicative functions the consolidation did little more than to bring the Commanding Officer of NMC under the chain-of-command of the Admiral stationed at the Point Mugu complex.

1. <u>Environmental Influences</u>

Almost concurrently with the 1970 Point Mugu consolidation, NMC was placed under the Navy Institutional Funding (NIF) system. NMC, as a NIF activity, would require customers to pay for the total cost of services provided, direct cost plus a share of the overhead. PMR, however,

would remain solely institutionally funded and "free-of-charge" services would continue for range users. NMC recognized the new funding technique as a means of expanding and improving existing resources. NMC aggressively sought increased business and actively competed with other T&E facilities for new weapons program selections. During the period of 1970 to 1974 NMC increased its annual business activity from approximately $40 million to over $100 million. PMR, on the other hand, had little control over improving its existing assets. With defense appropriations shrinking, PMR's institutional funding leveled off at $61 million during the same period, as reported in its FY 74 budget forecast. Stagnation continued to be a way of business at PMR, with no motivation for improved efficiency.

Since the consolidation, unrest and turmoil have hampered operations aboard the Pt. Mugu complex. Lack of direction from higher authority was recognized as a primary source of discontent. Coordination of T&E activities was nonexistent. As a result, T&E field activities functioned autonomously, lacking clear objectives on where to concentrate their efforts. Fearing exclusion from new programs, T&E activities attempted to keep their technology base broad enough to permit inclusion in future programs. While NMC, under its NIF funding, was able to take advantage of the competitive environment and market its services to potential users, the lack of T&E coordination was detrimental to PMR. PMR's inclusion in a program had to be determined early enough in a weapon systems' development to provide sufficient lead time for development and installation of the sophisticated equipment needed for the range. Other National Ranges possessed enough functional characteristics similiar to PMR to threaten its exclusion. Since funding for National Ranges was through appropriations categories originating at the DoD level, PMR personnel had little influence over their own future. Frustration

permeated throughout the PMR establishment. Personnel felt unable to measure their effectiveness in comparison with other range activities and, consequently, helpless in determining future programs' range selections.

Although the majority of projects, by dollar value, contracted by NMC required the use of PMR facilities, there existed a definite lack of cooperation between the two activities. Communications flow between the two activities was poor. Each command maintained its own contact point for external inquiries on the progress of the same program. Duplicative functions again grew. In one instance, both commands were developing a data instrumentation package for the same purpose without each other being aware of it. By disassociating itself from PMR, NMC was able to disclaim responsibility for inadequacies arising during the range phases of the T&E. The reason for the rivalous relationship, rather than a cooperative atmosphere, wasn't clear but perhaps NMC's insistence on maintaining its separate command identity was to blame.

D. REORGANIZATION PROPOSED

In 1972, the new Commanding Officer of PMR recognized a need to set aside the growing unrest that was affecting the entire organization. He cited that lack of direction from above was hindering PMR's ability to evaluate itself. No clear dividing line of responsibility between Washington and field activities existed. A series of ad hoc committees were formed to investigate the difficulties existing at the Point Mugu complex, while the Command focused its thrust upon stirring up action in Washington. Shortly thereafter, the new Commanding Officer announced that he was proposing a reorganization of Pt. Mugu. External support for the reorganization was gained by claiming that over 300 jobs could be eliminated through the reorganization. Internal

pressure against the proposal mounted. Personnel production suffered due to the uncertainty of job security. The command billet at NMC, which was a popular career enhancing billet normally held by an Aeronautical Engineering Duty Officer (AEDO), was also threatened by possible extinction. Elimination of the billet was strongly opposed by the AEDO community.

Before the reorganization obtained enough support for implementation, another shock wave infiltrated the complex. Early in 1973, the Shore Establishment Realignment (SER), which was successful in closing the Hunters Point Shipyard, at the cost of over 4000 jobs, announced plans to turn the range functions at PMR over to private contractors, thus eliminating 1400 jobs. The employee organization responded vigorously to squelch this latest proposal which was eventually defeated by Congress. Meanwhile, the SER incident had dominated the scene through 1973 and the reorganization never became a reality. Due to the opposition from both within and external to the organization there existed strong doubts that, even without the SER, the reorganization would have been accomplished.

E. LATEST EVENTS

By 1974, it became increasingly obvious to the Washington based Navy hierachy that the consolidation of PMR in 1970 had accomplished very little towards increasing the complex's effectiveness. With the exception of eliminating some duplicative functions, the two primary activities at Point Mugu had suffered considerable internal strife. The arrival of a new Commanding Officer at Point Mugu, in June of 1974, was overshadowed by two significant events: 1) NMC was no longer in the chain-of-command of the COMPMR, but instead, was reinstated as an echelon 4 activity, reporting

directly to NAVAIRSYSCOM; 2) The National Ranges would now charge users all direct costs associated with their projects.

The reestablishment of NMC as an echelon 4 activity reasserted the apparent, that NMC was indeed a separate field activity. The fact that NMC's funding authorization flowed directly from NAVAIRSYSCOM had seriously hindered COMPMR's ability to exercise any real control over NMC's operations. Whether or not NMC's "new found" autonomy would have a positive effect on Point Mugu's effectiveness was questionable.

The direct cost to customers scheme would certainly have an effect on PMR's mode of operation. Not only would range users be able to assess ranges on the less tangible characteristic of service quality but, also, by the more objective method of service cost. Whether or not PMR could successfully respond to the new challenge of keeping costs down was uncertain, but what was certain is that PMR was given a motivation for efficiency and an opportunity to evaluate itself relative to other ranges. The stagnancy that degraded PMR's effectiveness in the past wasn't tolerable under the new funding method, which would instill a competitive operating mode among the various ranges for the T&E dollar. Not only would cost efficient operations mean more business activity for PMR, but also would weigh significantly in the amount of institutional funding flowing from DoD for expansion and improvement of facilities. General Starbird, DD(T&E), DoD, has closely monitored the allocation of institutional funding for the various T&E activities and has been a strong advocate for efficiency measurements of T&E facilities. He has made his opinion quite clear; the cost efficient facilities will receive the dollars. PMR personnel have recognized the impact of the funding change and have initiated efforts to include

marketing in their mode of operation.

No sooner had the events of June 1974 been absorbed when the new COMPMR released startling news. He felt the present organization wasn't responsive to the Navy's T&E needs and that, consequently, a reorganization would be studied. The changes proposed by the Admiral were radical and would totally eliminate NMC's identity. To appease opposition from the AEDO community, he proposed that an AEDO would hold the second highest billet, vice commander, and he would have responsibilities commensurate with the NMC command position. Internal resistance never surfaced, as with the previous reorganization proposal, since no jobs were proposed for elimination. Washington's support was achieved by selling the benefits of a reorganized Point Mugu complex and avoiding any inferences to inadequacies existing at upper echelon operating levels. The new organization was to be named the Naval Weapons Test Center (NWTC) thus avoiding any inference to the PMR. The reorganization gained acceptance. However, just prior to finalization General Starbird, a strong opponent of service parochialism, objected to the use of Naval in the title. Navy officials acquiesced, and on April 25, 1975, the Pacific Missile Test Center (PMTC) was established.

The 1970-1974 timeframe at Point Mugu was not a productive period in terms of efficiency. Internal managerial problems and lack of external guidance are identified as primary reasons. The PMTC organization is an attempt to solve many of the internal problems and is structured to be more responsive to external activities.

F. PACIFIC MISSILE TEST CENTER

Specific documents addressing the need for

reorganization of the Point Mugu complex were not available for general dissemination. However, several studies in recent years have identified the need for improved organizational effectiveness of T&E facilities in general (Refs. 17, 18, and 19). The data justifying a reorganization is limited to personal interviews of personnel at Point Mugu and the subjective conclusions stemming from these interviews.

1. Need For Reorganization

The following is a list of specific problems recently identified as affecting the overall effectiveness of the Point Mugu complex which, unless otherwise noted, refer to the range organization.

a. Lack of Technical Advice

The mode of operations on the range has been technically passive. The user requested a certain service and received whatever the range was capable of providing. The technical competence exists at the range to advise the user of what he needs rather than what he wants. Range personnel, familiar with its limitations, could most adequately accomodate a user's requirements by tailoring need to match the range's capabilities.

b. Lack of Cooperation

Both the range and the missile center have the same basic mission of supporting T&E. As such, both must operate on a cooperative basis for without one there would hardly be a need for the other. However, as the previous development has shown, this was not the case.

c. Unclear External Perception

To the user who was having T&E performed at Point Mugu there was little distinction between the range

and the missile center. When a question arose that needed to be answered immediately, he frustratedly discovered that he would have to make a distinction between which activity to direct his inquiry since both activities maintained separate contact points on projects and made little attempt to communicate with each other.

d. Staff Duplication

This challenges the need for duplicative staffs at two activities, located at the same geographical point, whose functions are complementary.

e. Long Range Planning Conflicts

It is hard to believe that activities at this level can justifiably plan for their future involvement in particular weapon systems when that determinatioion is dependent entirely on decisions made at higher echelons. However, lack of guidance from higher authority has forced PMR & NMC to plan their future involvements. Unfortunately, both activities do this independently, failing to recognize their own vested interest.

f. Personnel Stagnation

A common complaint in any organization with tenure status is the problem of how to deal with tenured personnel who cease to contribute useful benefit to the organization. Key managerial positions have been filled by the same people for many years who have resisted changes to their mode of operation. One person stated "When a RIF (Reduction in Force) occurs, the best people must go and we're left with the deadwood. The only thing we can do is try and build the organization around them."

g. Empire Building

Personnel stagnation has also fostered "empire building" with separate units within the organization

functioning almost independent of the Command. One department promulgated its own five year plan while the staff prepared one for the department also.

h. Improper procedural Implementation

Changes were generated at the Command level and presented to the executive board for dissemination. Functional managers did not participate in policy implementation. Ideas flowed strictly down the chain-of-command without a feedback mechanism.

i. Inadequate Reports

The management information system generated data inadequate for managers to make decisions. Reports were structured in financial terms only, suitable for a financial analyst's interpretation. As a consequence, the comptroller was involved in making decisions which should be made by functional managers. The comptroller should have only been responsible for the operation of set policy and not engaged in planning decisions.

j. Inappropriate Involvement

NMC, through its agressiveness, has inherited some responsibilities not involved with their primary mission. At times, problems in these areas have tended to bog down the Command's effectiveness. The Threat Simulation Department, which was responsible for target development belonged under the cognizance of the range activity. Aircraft maintenance is normally the responsibility of a Naval Air Station and not of a T&E activity.

2. Corporate Characteristics

The PMTC organization, recently established at Point Mugu, was a radical change from the previous organization. Many of the new innovations incorporated were developed

following a comprehensive presentation from the Vice President of Management Systems at the TRW Corporation. The dynamic characteristics of TRW, which were considered necessary to remain competitive in the rapidly changing technological environment, were also considered suitable for PMTC's interface with the T&E environment. By instituting a TRW-like organization, PMTC would be acquiring both the strengths and weaknesses of TRW's organization.

The matrix project mangement method of TRW (Ref. 20) assigned project managers from the functional departments of the organization to manage the company's total life involvement in a project. Upon completion, the project manager returned to a functional assignment. This had proved to be beneficial, in that project managers were kept abreast of the latest technology and personnel stagnation was avoided in project management positions. On the other hand, selection to a project management position was temporary and, once the project was completed, there was no assurance that his old position would still be available. Consequently, qualified personnel would sometimes shun the opportunity for visibility as a project manager.

The matrix project mangement method also provided for efficient allocation of personnel. More flexibilty existed to shuttle personnel to work on other projects when not needed on a particular one and, consequently, eliminated a large amount of idle manpower. This benefit was traded off with the increased cost collection problem of identifying the costs associated with a particular project. Personnel could be working on more than one project during the the same period and the problem of cost identification increased. One of the reasons for successful project completions has been the personal integrity of the personnel which motivated them to work extra hours to get the job done. To what degree personnel at PMTC will be motivated has yet to be determined.

3. The Organization

The resources of the Naval Missile Center and the Pacific Missile Range were combined into the Pacific Missile Test Center whose mission is (Ref. 21):

> "To perform development test and evaluation, development support, and follow-on engineering, logistic, and training support for Naval weapons, weapons systems, and related devices; and to provide Major Range, technical, and base support for Fleet users and other Department of Defense and government agencies."

PMTC is comprised of seven directorates and two management groups (Figure 5). Of the seven directorates, three are directly involved with the functional aspects of current T&E projects and another, the Fleet Weapons Engineering Directorate, follows the life cycle of a weapon system after it has completed development at PMTC and is introduced to the Fleet. Two other directorates, PMRF Hawaii, and the Marine Air Detachment, have functions not directly affected by the reorganization. A brief discussion of the other directorates and the two groups follows.

a. Naval Air Station

An institutionally funded directorate whose main function of operating and maintaining base facilities and provide base support services for the PMTC and assigned tenant activities will remain relatively intact. In addition, NAS assumed responsibility for aircraft maintenance, formerly performed by NMC. The Surface Craft Department, whose function was to operate, maintain, and provide surface craft in support of range operations, range surveillance, and area clearance, was shifted to the Range Directorate.

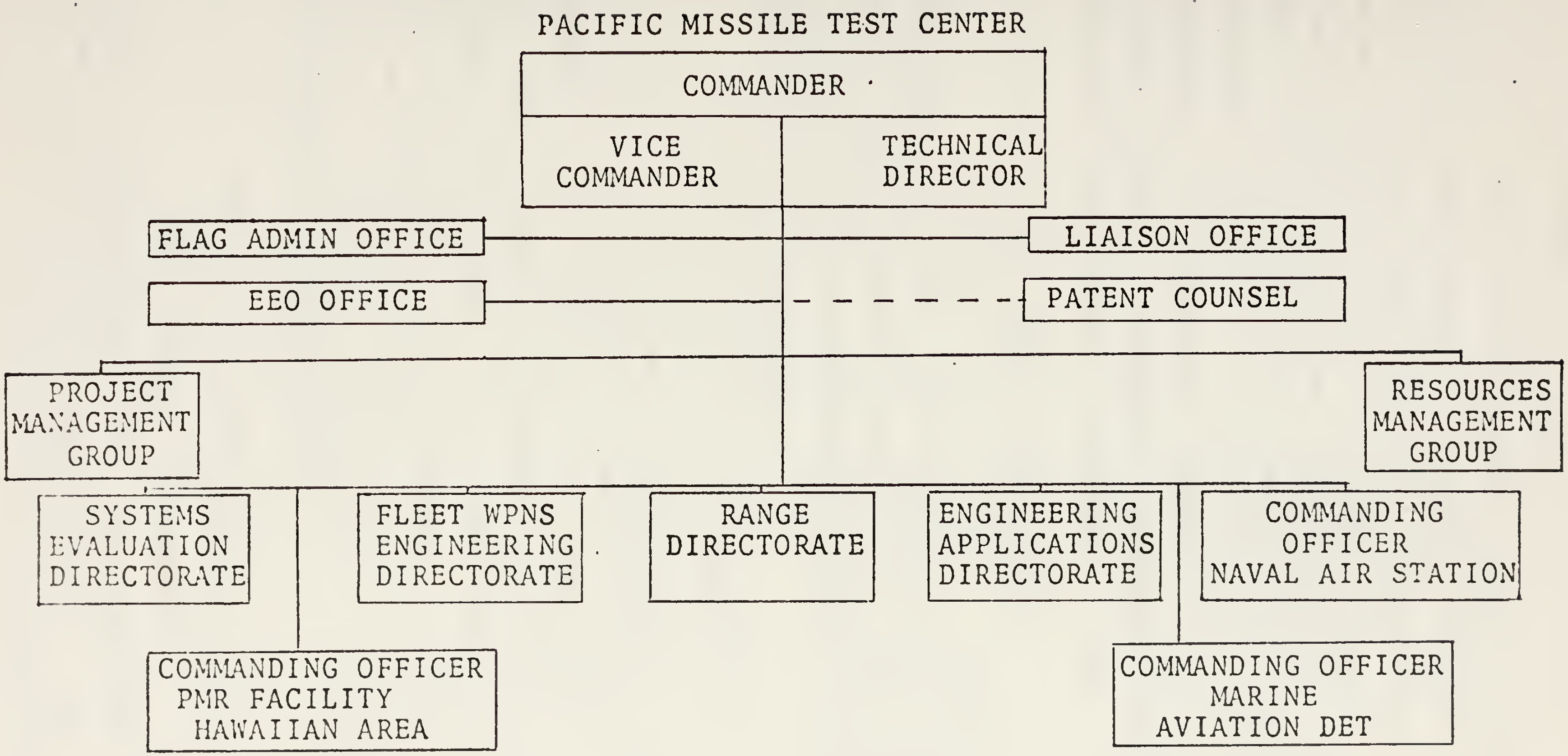


FIGURE 5
PMTC ORGANIZATION

b. Range Directorate

An institutionally funded directorate with a strictly operationally oriented function that provides assigned Major Range services, related range facilities, and target systems for PMTC projects, including development of range systems, subsystems, and techniques. The heart of the PMR, the Range Directorate charges users direct costs for services rendered. Released from all non-operational functions, the directorate assumed responsibility for the Surface Craft Department's functions of NAS and the Threat Simulation Department's functions of NMC.

c. Fleet Support Directorate

Formerly the Fleet Weapons Engineering Department of NMC, this directorate's function remained intact. The directorate provides the single entry point for all PMTC in-service engineering projects after completion of test and evaluation phases.

d. Systems Evaluation Directorate

A NIF funded directorate, the directorate provides the technical expertise needed to appraise a customer's T&E requirements. Comprising many of the functions of NMC's Laboratory Department, the directorate performs development test and evaluation, development support, test and evaluation support to in-service engineering of Naval weapons, weapons systems and related devices, including development of test and evaluation technologies and methodologies.

e. Engineering Applications Directorate

A NIF funded directorate, the directorate assumed responsibility for the functions of the Data Analysis and Processing Department of PMR, some of the functions of the Data Analysis and Processing Department of

PMR, and some of NMC's Laboratory Department's functions. Through its department, the directorate supports the prototype design and fabrication needed for PMTC projects as well as photographic and instrumentation requirements.

f. Project Management Group

Through this group, the project management matrix technique is enacted. The group represents the single entry point for PMTC projects providing project management, coordination, and information for PMTC projects. For adequate customer responsiveness, the group has mirrored the structure of the NAVAIRSYSCOM Project Managers' offices, a major source of PMTC projects. Similar to the autonomy enjoyed by NAVAIR Project Managers, Project Officers work directly for the Commander PMTC, while obtaining administrative support from the PMG. By operating in the classical matrix mode, the Project Officer crosses horizontally through functional lines in the organization to ensure proper project development. The Project Officer is not supposed to infiltrate vertically through the organization by involving himself in the day-to-day tasks which are the responsibility of functional task managers. His primary concerns are time and cost. Project priority is set by the Director of the PMG and thus avoids conflicts between Project Officers and functional managers over priorities, traditionally a source of conflict.

g. Resources Management Group

This group provides a unique aspect to the PMTC organization in that it provides a new approach to resources management. The group's function is to provide policy guidance, advice, and integrated planning and information for the management of the PMTC financial, workforce, and physical resources, and provide support to all PMTC management levels. By its method of operation, the group encourages participative involvement throughout the

organization by acting as a focal point for both policy planning/implementation and resource allocation. The RMG could best be described as a matrix organization in reverse, distinguishing itself from the normal matrix/staff organization. An example would best serve to point out the differentiation:

> Under a matrix/staff organization a department head, citing a need for a financial analyst in his department, would set about to hire a financial analyst. After finding someone that appears suitable for the position, using his limited knowledge of finances as a criterion, he hires the person. The newly hired person works for the department and is evaluated based on the department head's appraisal of his work. The comptroller, in a staff position, has no direct control over the analyst's performance and exercises minor control through the department head.
>
> Under PMTC's organization, the head of the RMG's Comptroller/Financial Mangement Department cites a need for a financial analyst in a department. All the financial analysts work directly for him and, consequently, he is able to shift them wherever he deems appropriate. Quite often, another department may have an overallowance and, an analyst can be shifted to the department needing him, thus precluding the hiring of an additional analyst. The analyst works directly for the comptroller, providing financial services to the department.

The centralization of resources has great advantages in resource allocation. If a directorate cites a need for additional office space, the Property Management Division of the RMG can objectively evaluate the request and determine the most efficient allocation of additional office space, considering the overall benefit to PMTC. Through the Work

Force Management Division, personnel talent can be most effectively distributed throughout the organization. It provides a vehicle for moving people between directorates to develop competent Project Officers. The dynamics of personnel movement, used by the division, can also be used to eliminate the problem of personnel stagnation.

The centralization of resource allocation may have taken some control away from the directorate heads but the advantages of centralization appear to outweigh this drawback. Looking from another viewpoint, the directorate heads no longer need concern themselves over proper resource allocation and can direct their energies to the prime objectives of their directorate. Within each directorate there is a resources office which is responsible for the financial functions and which also has personnel reporting to the RMG on matters of planning, property mangement, management systems, and work force management. The planning aspect of the RMG provides an excellent vehicle for two-way communications and policy/change implementation. The directorates, through the RMG, state the need for a policy change to the Executive Board, comprising the heads of all the directorates and the COMPMTC. The Board reviews the proposals recommended by the RMG and makes the decision. The RMG then disseminates the policy guidance and manages its implementation. Through the RMG, the Command hopes to attain participative management throughout all levels of the organization.

G. FINDINGS

Many of the problems afflicting Point Mugu have been eliminated by virtue of the reorganization which eliminated separate command identities. Still present are the people who were involved in and caused many of the problems that plagued the complex for so many years. The new organization

provides a better means for the Command to react to the changing external environment. Internally, the organization possesses the dynamic capability to adequately assign its resources and obtain their most beneficial contribution. What remains to be seen is if the personnel will provide the cooperation and the flexibility the new organization demands. Only through personnel motivation can the problems of technical advise and lack of cooperation be eradicated. The external perception of PMTC can best be improved by customer satisfaction, again, a function of personnel. The problem of inadequate reports is still being addressed. A centralized, highly elaborate Management Information System (MIS) is proposed that will provide the proper information needed at each level of management to put the decisions back in the hands of the functional managers. Inappropriate involvement has been reduced by attempting to identify the most suitable directorate for functions and by eliminating those functions which serve no useful purpose in PMTC's mission. The RMG provides an adequate policy implementation and feedback mechanism, enhancing the principles of participative management. Additionally, the RMG has a rather effective method of eliminating personnel stagnation by moving personnel out of key positions under the guise of personal development.

Other T&E activities are also recognizing their organizational inadequacies and are presently revamping their organizations for more efficient operations. NATC has also just undergone a similar type of reorganization. Yet to be resolved are the inadequacies of upper echelon direction and coordination. A separate command at NAVAIRSYSCOM is being established to bring the T&E effort under a unified command. The COMPMTC is now proposed to "double hat" as AIR 0-6R in charge of Ranges & Targets, while COMNATC is to "double hat" as AIR 0-6T, in charge of Test and Evaluation. This will put COMPMTC in charge of

some of NATC's resources and vice versa. This might lead to some problems but the final details have not been worked yet. In any event, the Navy organization is finally recognizing its inadequacies in the T&E area and is working towards a solution.

IV. FINANCIAL MANAGEMENT

In this chapter the reader is introduced to both the Navy Industrial Fund (NIF) and the Resource Management System (RMS) managerial concepts. The Navy's RDT&E facilities are normally funded and financially managed by one of the two methods, either under NIF or by institutional dollars under RMS. An examination of PMTC is then done in order to acquaint the reader with the financial environment existing at a T&E installation.

PMTC is presently operating under both financial methods, NIF and RMS. This dual fiscal mode for PMTC resulted from the recent merger of the Pacific Missile Range, operating under institutionally funded RMS, and the Navy Missile Center, a NIF activity. Continuation of the existing two financial methods is assured until FY-77 when PMTC will become a modified NIF organization.

A. NAVY INDUSTRIAL FUND

Navy Industrial Funding is an accounting device that introduces into the management of government industrial and commercial type activities an integrated system of accounting according to commerical concepts including the utilization of a working capital account. Creation in 1949 of an industrial fund, NIF, within the Navy Department was pursuant to the authority granted to the Secretary of Defense under the National Security Act Amendment of 1949 for establishment of working capital funds in the DoD.

The needs for working capital funds such as NIF developed from Congressional investigation into the industrial facilities of the Military Departments during WWII. Studies made by the various Congressional committees

pointed to a definite lack of adequate cost accounting and the need for some means of accurate, yet simple, cost determination. By permitting the existence of working capital funds Congress constructed a financial management tool - "making those officals fully responsible for a direct accounting for the money they spend, the costing of each job, and the most economical method of accomplishing the work" (Ref. 22).

Objectives and benefits derived from a NIF managed installation are as follows in Reference 22:

> "1. To provide a more effective means for cost control over operations and a more effective and flexible means for financing, budgeting and accounting for such operations.
> 2. To promote a greater sense of responsibility or cost consciousness in customers of the industrial fund installations. The buying agency must actually pay for the goods and services furnished by such installations based on the availability of its funds.
> 3. To permit industrial fund activities to more effectively discharge their responsibilities by means of separate financing of operations and less cumbersome budgeting and accounting methods.
> 4. The managers of industrial fund activities should be motivated to operate their activity by the most efficient means because there will be more appropriate indicators of efficiency."

Introduction of NIF to an industrial activity such as a shipyard, an aircraft rework facility, or a research installation is accomplished by the formalization of a charter and the establishment of a working capital account. The charter represents the approval of the Secretary of

Defense for the activity to operate under industrial fund procedures. Additionally, the charter describes the activities working capital requirement, volume of business, procedures and rates to be used for cost allocation of requested services.

A significant part of the charter is the providing of initial working capital to the new NIF activity. It provides the cash to cover operating expenses and the liabilities which are assumed initially, together with provision for the required investment in inventories of raw materials and supplies. Working capital net amount, subtracting such items as accounts payable for goods and services, and annual leave of employees, is then available as a revolving fund to finance the cost of goods and services produced for the users of the activity. Reimbursement of the industrial fund is accomplished by billing the appropriation account of the using activity for goods or services rendered.

A buyer-seller or a contractual relationship exists between the industrial fund activity and those organizations requiring its products or services. Existence of a buyer-seller relationship commences with the submission of an order by the buyer for a specific product or services and its acceptance by the selling activity at an agreed upon price to be paid by the buyer. Agreed upon price is at a standard rate established in the charter. The customer is responsible for budgeting and budgetary control for the cost of end-products and services ordered from a NIF activity. Figure 6 illustrates the cycle of operations under NIF financing.

Rate for services and products will vary among facilities under NIF according to the installation's unique overhead expenses, use of institutional appropriations, or accounting method used to distribute costs. For example,

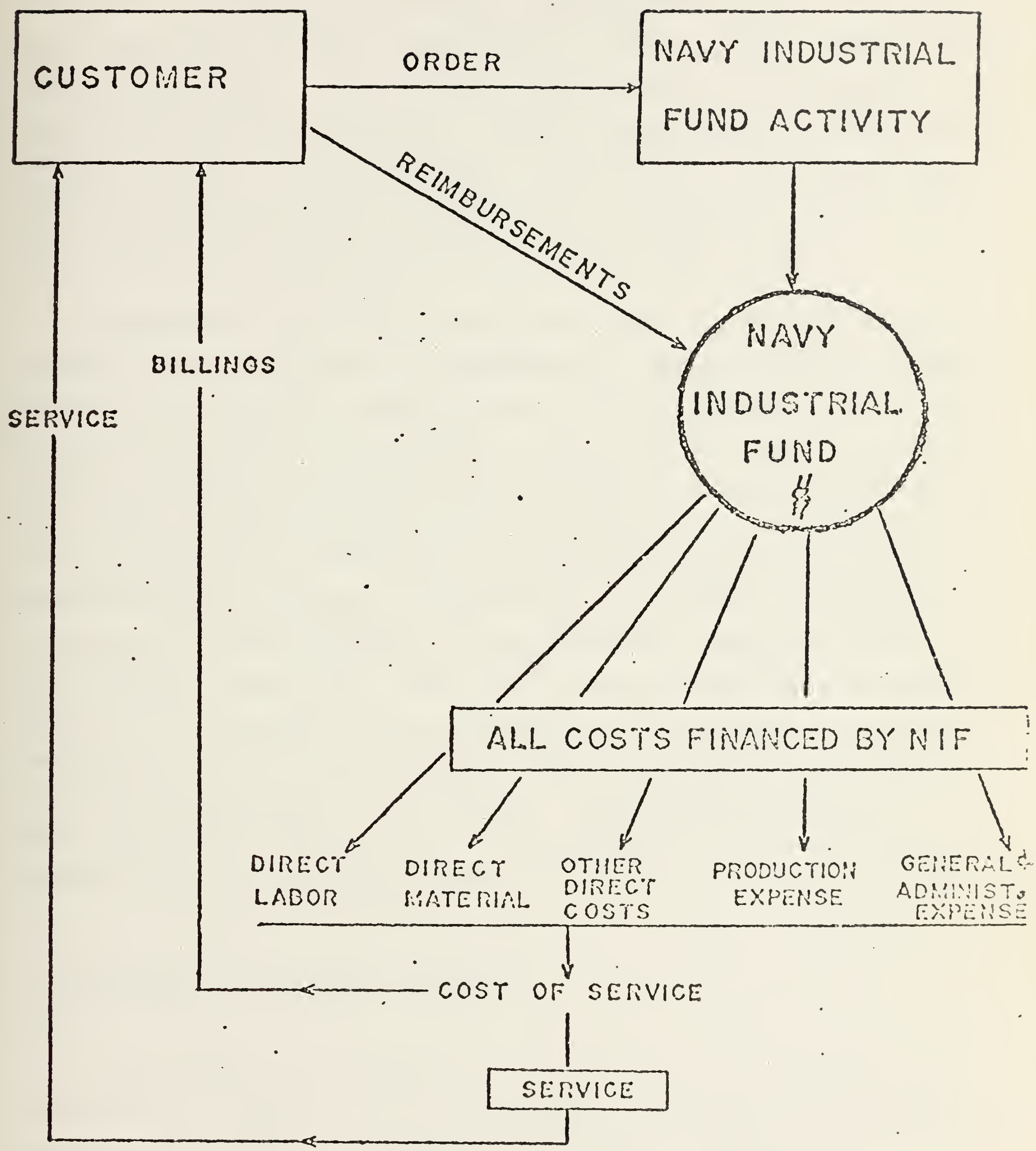


FIGURE 6. NIF FUNDING CYCLE

data gathered on five NIF installations indicated a large difference in actual cost passed on to the user. NATC Patuxent River and NAPTC Trenton have a rate per hour to a customer of $9.47 and $9.82, respectively, and a rate per hour total cost to the facility of $27.15 for NATC and $27.49 for NAPTC. In each case there exists a difference of approximately $18 per hour. For NAF Indianapolis, NWC China Lake, and NMC Point Mugu, both the rate per hour total cost and rate charge to the customer were identical: $17.58 for NAF, $18.74 for NWC and $18.60 for NMC (Ref. 23).

Dependence of an industrial fund activity on the revenue it earns from its customers to replenish the working capital plus the buyer-seller relationship are two incentives which contribute to good management. These elements influence an industrial activity and its users much the same way as customers and managers in private business are influenced by competition and the necessity for economic procurement and control of spending. A customer is motivated to order only that product or service for which he has a real need, since it must be paid for out of his annual operating allotment. The contractual relationship pressures management of an industrial fund organization to improve cost estimating and cost control. DoD Directive 7410.4 of September 25, 1972 (Ref. 24) offers the reader further information on Industrial Funds.

B. RESOURCE MANAGEMENT SYSTEM

DoD Directive 7000.1, as stated in Reference 25, reflects a change in views within the Federal Government concerning what constitutes good performance by administrators. Now performance is judged by cost-effectiveness and output. This is done through the measurement of management's use of resources during specific

periods by comparing actual with budgeted expenditures. Older governmental management systems had different objectives and were concerned only with legitimate use of public funds. New changes in performance criteria require corresponding changes in management and information systems.

The Navy response to the Directive was its Resource Management System. RMS is a managerial procedure which improves the planning, control and optimal utilization of scarce resource (money, material and manpower) at the lowest practical work level of an RDT&E activity, identified as a cost center. Participative management is encouraged within the RDT&E facility and between the activity and its Systems Command Headquarter. Both the cost center and activity command management receive greater degree of responsibility and a larger role in decision making concerning what work they do, their budgeting request, work schedule and progress.

Several advantages over previous management systems are accomplished by RMS. Reporting efforts under RMS show data on the same basis as the budget. There is a basis for evaluating performance of personnel, equipment, material and projects in relation to cost. A history or data base for future planning is created. Management decisions are made more accurate and easier by hard data (Ref. 24). The improvements are a result of cost center activity in planning of resources, execution of the budget, the accounting for resources, and financial responsibility. RMS combines the expanded managerial functions of cost centers into a single system in which the functions interact with each other.

For task assignments under institutional funding, RMS encourages a more objective comparison of task output against the resources put into the task. Institutional

funding, sometimes called "bucket" funding, provides to an activity through its "Approved Operating Budget" a source of obligational authority by which to operate. The "Approved Operating Budget" is the appropriate Systems Command Headquarter's response (NAVAIR for PMTC) to the organization forecast of services rendered on task assignments from its sponsor. Figure 7 is a graphical depiction of the institutional funding flow from Congress to a cost center.

An activity is not limited to performing services only for its sponsor. It may receive work request from external users, such as OPTEVFOR or a NIF funded organization. Work performed on these task assignments are on a reimbursable arrangement. Customers are charged the cost of the services or goods produced for them, which include the direct cost and possibly the allocated overhead.

Under RMS, all military labor, direct or indirect, including duty is considered statistical. The label "statistical" means military labor is not actually included in the total costs of a cost center. It is budgeted, however, because it is necessary to know for managerial and statistical purposes the actual number of military hours and dollars used, and how they are used. Statistical military labor is often described as unfunded military labor (Ref. 25).

The mission of the responsibility center, cost center, and sub-cost center determines the nature of the workload to be accomplished. In formulating resource planning requirements to accomplish anticipated workload, work is classified into meaningful categories of programs, functions, objectives, etc. This entails the identification of specific objectives, programs, functions, tasks, or projects, establishment of appropriate job order to collect and identify costs incurred, identification of the resources

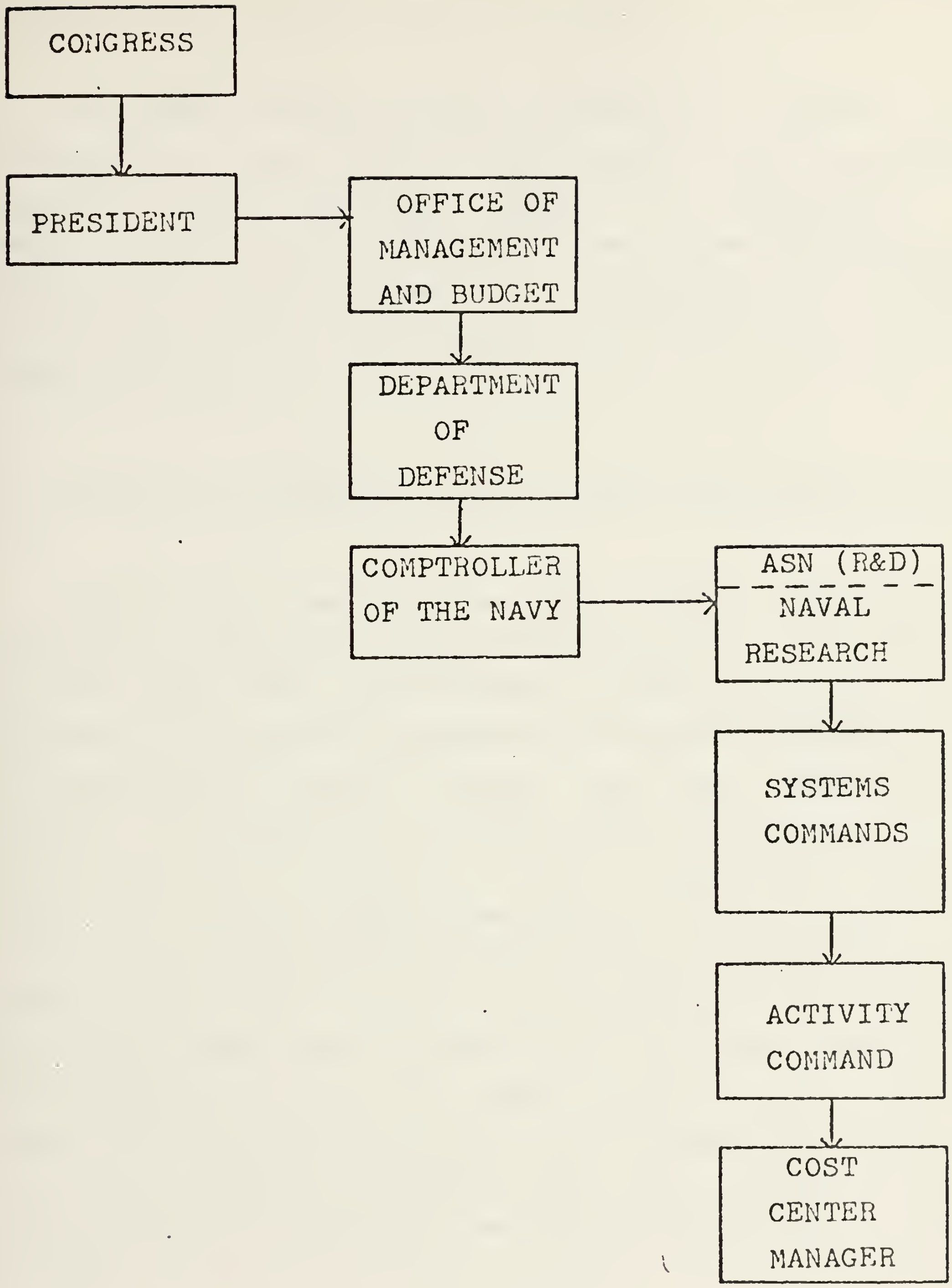


FIGURE 7. FLOW OF INSTITUTIONAL DOLLARS

required, and development of time schedules (fiscal quarters) for accomplishment of effort.

At PMTC, the RMS network consists of sub-cost centers (divisions), cost centers (departments), and responsibility centers, which generally equate to directorate level organization. The network of cost centers facilitates the preparation of the budget, the recording of accumulated expenditures and, most importantly, the fixing of resource responsibility.

C. FINANCIAL MANAGEMENT AND FUNDING PROCEDURES FOR PMTC

PMTC continues to use the fiscal procedures and financial management which existed prior to the unification of PMR & NMC. PMR, while under the RMS managerial concept, received its fiscal procedures and funding guidance through two mediums: the Major Ranges and Test Facilities Base (MRTFB), as specified in DODDIR 3200.11, as well as RMS, as promulgated by the Office of the Comptroller, Navy, for RDT&E activities. MRTFB prescribes a uniform funding policy that has been implemented at all 26 member activities of the MRTFB. The uniform funding policy conceived and executed by the Defense Department states that all direct costs of an MRTFB activity will be paid by the using activity or organization, costs which are not reimbursed by the user, such as overhead expenses, will be funded by the DoD component who is managing the installation, i.e., the Navy for PMR.

A job order cost accounting system is required of participating members by the MRTFB to support DoD uniform funding policy. Such a job order system does exist at PMTC for both MRTFB and NIF directorates. Once a work request is accepted by PMTC, an operation number is assigned to it.

Then all labor and material used on the work request is recorded to that specified operation number. The system simplifies the audit trail but necessitates a high degree of data recording.

Directorates falling under MRTFB/RMS are those comprising PMR former functions and personnel plus the Program Management Group and the Threat Simulation Department from NMC and the Naval Air Station organization, including the Aircraft Maintenance Department (AMD). AMD was a separate department in NMC and was operated under NIF. NIF managed directorates in PMTC number only three, with the heart of NMC transfered to the Systems Evaluation Directorate.

Following is a list of the directorates and their personnel level. Prior to consolidation, PMR work force consisted of 556 military personnel and 2422 civilians and the NMC manpower complement was 443 military and 1,937 civilians (Ref. 26).

Directorate	Officers	Enlisted	GS	Total
MRTFB/RMS				
COMPMTC	3	2	105	110
Flag Admin.	7	2	35	44
Liaison Office	0	0	3	3
Range/Target Off.	1	0	0	1
PMG	7	0	70	77
RMG	1	0	298	299
Range	38	128	1092	1258
NAS	48	595	1377	2020

Directorate	Officers	Enlisted	GS	Total
Marine Av. Det	0	0	2	2
PMF (Hawaii)	20	74	58	152
Total MRTFB	125	801	3040	3966
NIF				
Sys. Eval.	30	32	704	766
Flt. Wpn. Eng.	5	0	240	245
Eng. Appl.	2	13	741	756
Total NIF	37	45	1685	1767
Total PMTC	162	846	4725	5733

MRTFB/RMS directorates receive their operating dollars via the Naval Air Systems Command from the Navy RDT&E appropriated institutional funds as an RMS activity. The operating budget is examined and approved by higher authority within DoD and Congress under the policy of incremental programming of funds. Incremental programming provides that only those funds required for a given fiscal year are included in the authorization request. This compels the MRTFB directorates to program the funding for their RDT&E effort on an annual incremental basis as opposed to the fully funded program basis of the procurement appropriation (Ref. 27). Directorates' approved operating budget, constituting a separate and distinct program element within the DoD budget, is the limit of their obligational authority as set by Congress. Under RMS, obligational authority represents the maximum dollar value of goods and services which may be ordered during the fiscal year.

Institutional funds make up a large part of the operating revenues but not all of it. Approximately a fifth

of the dollars needed for day to day operatios come from the range's users through direct cost charges to them (Ref. 28) . This direct charge to users is a recent phenomenon resulting from a Defense Department study commencing in April 1972, chaired by Mr. George W. Bergguist, Deputy Assistant Secretary of Defense (Systems Policy and Information), of the funding policy existing at the 26 major ranges and test facilities including, at that time, PMR.

One conclusion reached in Mr. Bergguist's investigation was the necessity to improve cost control and economic efficiency among the MRTFB by charging the users the direct cost of services or goods ordered. A direct consequence of this study was DoD Directive 3200.11, dated June 18, 1974, which spells out that "all DoD Components and other Federal Government agencies will reimburse the major ranges and test facilities for direct cost". All costs not identifiable to a user are charged to institutional funds.

Appendix A projects a clear picture of: the growth of direct cost; who the users are; and past, present, and forecast operating budgets for PMR. Although PMR ceases to exist, the amount of institutional funds allotted to its range functions (directorates) will continue as part of DDT&E financial planning. DDT&E is the final approval authority within the Defense Department for budget requests from any of the national ranges and test facilities as assigned by DODDIR 3200.11.

Modernization and improvement funds for the RMS directorates come from several appropriation accounts including the RDT&E (N) institutional fund and Other Procurement Navy (OPN) appropriations. The PMR side of PMTC represents approximately a $150,000,000 investment in range instrumentation. An average life expectancy of the major range equipment is ten years, with instrumentation

obsolescence occuring sooner than that. This would dictate an annual investment of about $15,000,000 for necessary replacement and update to maintain current state-of-the-art range instrumentation systems. For the past ten years, PMR's budget submissions for range modernization and replacement have been cut in half. To make up for the deficiencies in appropriations of needed funds and to fulfill the projected needs of the Navy a $153,980,000 Range Instrumentation Procurement plan for the years FY-75 through FY-81 was prepared (Ref. 28). Appendix A gives a breakdown of this plan and Reference 28 reports on the major range asset acquistions.

The three directorates under NIF receive their operating revenue ultimately from the user via the progress payment method. Progress payments is the existing practice used by NIF cost centers for collecting accrued costs generated from: work requests, value of inventory identified and reserved for the user's order, and amount of work in progress. The customer receives a monthly bill for these costs. Reimbursement for services or goods ordered from the NIF cost center by a user within the Federal Government is accomplished by cross disbursement without the use of checks. Eliminating the needs of using checks is done by charging the appropriate fund accounts of the user activity and PMTC NIF fund the dollar value indicated in the billing. Collection of costs from external customers to the Federal Government is accomplished by checks.

Internal billing between PMTC's cost centers, both NIF and MRTFB, requires a specific set of rules to ensure compliance with DoD's MRTFB and Industrial Fund regulations. MRTFB's uniform funding policy permits reimbursement of direct cost, only, and NIF allows the collection of total costs. Direct work performed by a NIF cost center for a RMS customer cost center is charged on the basis of direct costs

plus overhead. Work for another PMTC NIF cost center is chargeable on the basis of actual costs, only, without overhead application. A RMS cost center charges only direct costs to a NIF cost center (Ref. 26).

Contrary to established NIF principles there is not a general overhead expense applied to the total cost. This slight deviation from NIF procedures is one of the effects present in PMTC current fiscal operations that is related to its dual mode financial management. Instead, general overhead is treated as an indirect overhead, allocated on a total population basis and added to a NIF directorate over head expense.

NIF directorates receive their funds for assets acquistion or improvement by two means. The dollars are either appropriated via a budget request or become available from the industrial fund. The choice of which alternative method to use for equipment replacement/modernization depends on the dollar value involved and/or initial utilization of equipment. Fund requests of less than $50,000 may be financed from the industrial fund with recovery of expenditure coming from operating costs charged to users. Costs of acquistions or improvements greater than $50,000 will be financed under appropriated funds. Machinery or equipment authorized within a customer order for fulfilling the work task may be financed from the industrial fund with recovery of costs from the customer. Equipment acquired in this manner will be disposed of in accordance with the user's instruction (Ref. 24).

Appendix A gives the major users of NMC and their respective funds spent at the facility.

D. FUTURE DIRECTION OF PMTC FISCAL MANAGEMENT

For FY-77 and on PMTC will operate under a modified NIF concept called Reimbursable Institutional Funding (RIF). RIF, developed by NATC Patuxent River Financial and Operating Cost Center, calls for institutional funding of an installation overhead generated by its range functions, with the range services direct cost paid for by the user. All non-range cost centers will operate under the normal NIF procedure, receiving reimbursement by users for the total costs incurred. Implementation of RIF at PMTC will cause a thorough examination of all directorates for the determination of cost centers which have a range related task and those which do not. The opportunity to have a cost center overhead expense absorbed by institutional funds vice customers' dollars could have a striking effect on the cost estimates PMTC will give to customers in the futute. An indication of this is the example stated earlier of five NIF activities and the difference in the rate per hour charged to a customer and that which the installation experienced.

By using RIF, PMTC and the Navy will be satisfying two conditions. The first is the uniform funding plan advocated by Mr. Bergguist's study group for all 26 major T&E support activities and implemented by DODDIR 3200.11. The second condition being met is the increased fiscal control and motivation a NIF financially organized activity gives to management.

The existing cost estimate procedure used in responding to a customer's inquiries is scheduled for improvement. The present system calls for a PMTC Project Officer, upon receiving a proposed work request, to pass on to the cost centers concerned a list of services or goods a user seeks to have filled. Each cost center forwards along its proposed cost estimate based on the labor, instrumentation, material, and other items involved. The Project Officer,

assisted by a finanical analysisist, then totals the bids and presents PMTC's proposal (Ref. 29).

The current system has several drawbacks. A cost center cost estimates for similar services requested by two different customers might not be identical since there exists inconsistency in who prepares the proposed costs. Likewise, conflict could exists between the Project Officer and the cost center manager. A Project Officer is inclined to present an optimistic price estimate on labor and material containing no margin for misfortune or overruns to a customer. This is in contrast to a cost center manager's compelling motivation to ensure full employment of his personnel and a shop operating at full capacity, The cost estimates a shop manager passes on for the services requested could reflect this view (Ref. 30). The presence of either individual's subconcious tendency may cause an inaccurate cost proposal to be presented to the potential user, having all concerned suffer the effects.

PMTC is working towards comprising a "catalogue" of all the goods and services that could be offered by the installation and their stated costs. This proposed cost determination system will necessitate extensive research and investigation into all PMTC services rendered and goods produced (Ref. 29). Initially, a determination of the actual costs expended on completing these functions in the past must be accomplished. Once actual costs are computed, an analysis should be done on costs for both validation of cost averaging and to ensure the efficient use of resources in accruing the expenses. This cost validation analysis will be a reoccurring event to ensure cost proposals stay in line with changing resource utilization efficiency, labor, and material rates.

V. TEST AND EVALUATION ASSESSMENT

A. MOTIVATION

Trips made to Point Mugu provided the authors with a fairly comprehensive impression of the role field activities play in the T&E evolution. Personnel at PMTC were interested in improving their relationship with Project Managers and, consequently, fostering a cooperative atmosphere. Personnel interviewed felt that they were operating in a competitive environment and that PMTC would have to actively solicit for participation in future weapons programs. To accomplish their objective they felt a need to: first, know what the plans for future weapons systems are, second, convey to Project Managers what their capabilities are for meeting these demands. They did not feel a suitable mechanism existed to achieve this objective.

The existence of a competitive environment has also been noted and approved with restrictions by higher authority. The Chief of Naval Material, in NAVMATINST 5450.27, stated:

> "...these activities have operated under broad mission statements and often overlapping functional assignments which have generated competition for resources. While this policy was acceptable during a period of transition, continuing progress in the establishment and strengthening of R&D centers makes it desirable at this time to modify and restate policy so as to focus more sharply the resources and efforts of each laboratory and center. It is the intent of this instruction to strike a balance between, on the one hand, a rigid definition of functions that would create monopolies, deprive sponsors of flexibility, and lead to a decrease in technical options and, on

the other hand, a dispersion of capabilities that would foster duplication, decrease effective application of resources, and promote competition for programs and resources. Flexibility and dynamic operation are recognized as keys to success in research and development operations. Thus the policies enunciated herein are designed to encourage creativity, to provide alternative technical approaches, to control competition, and to ensure coordination of in-house efforts."

In order to obtain a clearer idea of the relationship existing between the user and the facilities, it was decided to obtain the opinions of the Project Managers. Road trips by PMTC personnel to Washington D. C. indicated a wide variety of viewpoints existed concerning this relationship (Ref. 31). The data obtained was considered insufficient to form any definite conclusions. The best method for obtaining additional information would be through personal interviews with the Washington based Project Managers. Although desirable, this method was discounted due to funding and time constraints. The next best alternative was to conduct a mail survey.

Formulation of the questionnaire was predicated on learning the views and opinions of Project Managers in certain key areas of T&E. Through background investigation, research trips, and interviews conducted relative to the PMs and their interaction with the facilities, there surfaced five managerial functions that needed further exploration. Little was understood of the criteria used by PMs in their selection of a T&E facility; what were the factors and their order of importance? The latitude a Project Manager has in selecting a T&E facility was not known. It was felt that constraints such as technical conditions, project urgency, or DCP requirements might dictate which facility a PM must

use. The method used by a Project Manager to familiarize himself with the different installations was not known. Does he rely on past experience, other PMs, publications, liaison offices, a staff within the Systems Command, or a combination of these as his information source? Since competition does exist between T&E facilities, it was thought important to measure the PM's feelings towards this competitive environment. Furthermore, what were their opinions on the quality of services provided?

Once the categories for PM's responses were determined, formulation of the statements to explore those areas was begun. Wording of individual statements was aided through discussions held with individuals having T&E experience. Construction and validation of the statements was an involved process requiring the selection of response format and data analysis to be used, and location of a test sampling group to ensure question content and validity. A five choice response format was chosen as a reasonable solution to both the response format and data analysis requirements. This response format provided ease of data reduction and adaptability to the Statistical Package for the Social Sciences (SPSS) on file at the Naval Postgraduate School computer center. It also permitted the respondent a degree of flexibility in answering the questions.

After each category was thoroughly covered by its statements, an initial version of the questionnaire was prepared. Personnel with prior T&E experience were located and used as the test sampling group. Objectives of the questionnaire were explained to the individuals. The group was asked not only to complete the questionnaire but to communicate their comments concerning the composition and validity of each statement to the authors, either on the questionnaire or in person. Responses from the sample group were used to modify and improve the questionnaire before

mailing. Although the questionnaire was principally designed and directed to the Project Managers, it was felt some of the same issues were applicable to the OPTEVFOR community. Hence, the questionnaire was sent to VX-4 and VX-5.

B. QUESTIONNAIRE

This section presents the objective, result, and the conclusion reached for each question. Responses received from the questionnaire were examined and transfered to data cards for tabulation by the SPSS package. Results were then printed out in a format similar to that used in the SPSS package. Appendix B contains the questionnaire and input data. Abbreviations utilized are as follows: S.A.-strongly agree, A.-agree, N.O.-no opinion, D.-disagree, S.D.-strongly disagree.

<u>Question 1:</u> More than one Test and Evaluation (T&E) facility was capable of providing the similar services needed for my project.

1. Objective: Desired to establish the existence of more than one T&E facility which had similar environment (land, sea, or air), technical support, and physical plant to conduct the T&E required on a project. An implied assumption was made that no two facilities are identical in capabilities; but when an installation's functions are presented in the aggregate the summation of those capabilities are approximately equal to another installation capability total. This information could have been partially retrieved from a library research of the DoD's ranges and test facilities. A search of that type however, would not have indicated the perception held by Project Managers and Project Officers towards the existence of more than

one T&E facility capable of meeting their needs. One of the factors needed to show the existence of a competitive environment was duplicate capability at various installations.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	20	19.0%	33.3%	0	28.6%	19.0%
VX'S	20	10.0%	60.0%	5.0%	15.0%	10.0%
ALL	40	14.6%	46.3%	2.4%	22.0%	14.6%

	MEAN	MEDIAN
PM'S	2.952	2.429
VX'S	2.550	2.167
ALL	2.756	2.263

3. Conclusions: Most managers surveyed agree that duplicate capability exists at many installations. Most noticeable is the almost even split among the Project Managers in Washington towards this statement. Since facilities with comparable functions are present, it is reasonable to assume the occurrance of competition between activities.

Question 2: The technical constraints of my project limited selection to one T&E facility

1. Objective: It was believed that the technical requirements of a program's T&E could be of such an unique nature as to restrict a Project Manager to a single facility. There are several weapon systems that do require special T&E functions and would confine the selection process to only one activity. The relative size of the two groups, technically restrictive and non restrictive, was unknown. Additionally, the statement is again asking the individual to judge if duplicate T&E facilities exist.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	20	15.0%	30.0%	5.0%	40.0%	10.0%
VX'S	20	10.0%	20.0%	5.0%	60.0%	5.0%
ALL	40	12.5%	25.0%	5.0%	50.0%	7.5%

	MEAN	MEDIAN
PM'S	3.000	3.500
VX'S	3.300	3.750
ALL	3.150	3.650

3. Conclusion: Responses from Project Managers are the significant ones in this statement. Project Managers are concerned with a weapon system R&D and developmental T&E in constrast to OPTEVOR'S function of operational T&E. R&D and developmental T&E contain the area of greater technical constraints. Size of the two groups, technically restrictive and non restrictive, as viewed by Washington is approximately equal. A sizeable numbers of projects are compelled to use the one facility possessing those unique characteristics needed for the weapon system T&E. Good correlation exists between questions 1 and 2 relative to duplicate T&E facilities, i.e., 45% of the Project Managers believed they are technically constrained and 48% believed duplicate T&E facilities do not exist for their project.

Question 3: The urgency of my project limited selection to one T&E facility.

1: Objective: Two factors were considered in this statement, time and existing capabilities at T&E installations. The two elements are directly related and dependent on the other. The longer the lead time a project has, the greater is the possibility that

additional facilities could adapt to the T&E specification requirements; and conversely for a short lead time. As with the objectives for question 2, the relative size of these two groups, short lead time or long, was unknown.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	20	5.0%	30.0%	20.0%	40.0%	5.0%
VX'S	20	0	5.0%	25.0%	60.0%	10.0%
ALL	40	2.5%	17.5%	22.5%	50.0%	7.5%

	MEAN	MEDIAN
PM'S	3.100	3.250
VX'S	3.750	3.833
ALL	3.425	3.650

3: Conclusion: Urgency plays a significiant role at the Project Manager level and is almost nonexistent in OPTEVFOR. Urgency could be another element affecting PM's perception of duplicate capability among T&E installations.

<u>Question 4:</u> Current publications provide a useful source of information on the capabilities of T&E facilities.

1: Objective: Very little is understood of the technique used by Project Managers to acquaint themselves with the various T&E facilities. There are numerous publications, distributed both by the installations and the Services, that describe the mission, functions, and existing technical assets of the T&E facilities. It was felt that these publications either do not meet the information needs of the Project Mangers or are unfamiliar to them.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	21	0	42.9%	23.8%	23.8%	9.5%
VX'S	20	0	25.0%	10.0%	40.0%	25.0%
ALL	41	0	34.1%	17.1%	31.7%	17.1%

	MEAN	MEDIAN
PM'S	3.000	2.800
VX'S	3.650	3.875
ALL	3.317	3.429

3. Conclusion: Printed information on installations and services they can offer needs to be improved. Current publications are not providing a useful source of information to OPTEVFOR and are disregarded by more than half of the PMs. It appears that an improved flow of information to the users of T&E facilities at an economical cost is possible through better constructed and formulated publications.

Question 5: Other Project Managers provide a useful source of information on the capabilities of T&E facilities.

1. Objective: In the investigation of the method used by Project Managers in gaining a knowledge of an installation's functions and ability, it was suspected that other individuals play a role. A key person might be another Project Manager. Possibly his predecessor, in the pass down, left either written or verbal information as to a facility's capabilities. Additionally, existing Project Managers, acting as a corporate memory, could be a source of knowledge and a readily available group to answer questions.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	21	4.8%	61.9%	14.3%	14.3%	4.8%
VX'S	20	30.0%	35.5%	10.0%	25.0%	0
ALL	41	17.1%	48.8%	12.2%	19.5%	2.4%

	MEAN	MEDIAN
PM'S	2.524	2.231
VX'S	2.300	2.071
ALL	2.415	2.175

3. Conclusion: An important reservoir of knowledge and information is an individual's contemporaries. The reputation and past associations a facility has among this group will affect future relations. This "informal" information link can provide much valuable information which would require volumes of technical manuals to cover. There is, however, the danger of loss of objectivity in the utilization of such a source. One especially good or bad incident may greatly color an individual's attitude toward an installation. There also exists the danger of not completely weighing all the factors but merely going with the "current favorites".

Question 6: Liaisons from T&E facilities provide a useful source of information on the capabilities of their facilities.

1. Objective: Most T&E facilities maintain a Washington liaison office. The office forms a communication channel between the Systems Command Headquarter and the field installation. It would appear that these liaison offices should be a center of available information and a source capable of answering a Project Manager's inquiries. An indication of their effectiveness as a useful source of information should

have come from the responses given.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	21	19.0%	42.9%	9.5%	23.8%	4.8%
VX'S	20	20.0%	60.0%	5.0%	15.0%	0
ALL	41	19.5%	51.2%	7.3%	19.5%	2.4%

	MEAN	MEDIAN
PM'S	2.524	2.222
VX'S	2.150	2.000
ALL	2.341	2.095

3. Conclusion: Liaison between the T&E activity and OPTEVFOR appears to be strong and effective. There is adequate communication between Washington and the T&E installations, but not totally effective. A large number of Project Managers are not being reached, as indicated by the 38% negative response from this group. A liaison office which can effectively present current information on its installation capabilities and technical expertise to the PMs could be a valuable asset to a decision maker during his selection process.

Question 7: A Project Manager's previous assignment provides a valuable source on information on the capabilities of T&E faciliies.

1. Objective: It was thought that a Project Manager might already have a well conceived impression of existing capabilities at T&E installations. These impressions are based upon previous experiences gained from T&E related billets or operational duties. Question 36 addresses previous T&E experiences.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	21	38.1%	28.6%	9.5%	23.8%	0
VX'S	20	35.0%	30.0%	10.0%	10.0%	15.0%
ALL	41	36.6%	29.3%	9.8%	17.1%	7.3%

	MEAN	MEDIAN
PM'S	2.190	1.917
VX'S	2.400	2.000
ALL	2.293	1.958

3. Conclusion: As stated in the conclusion of Question 5, reputation and past associations between an individual and a facility will form the basis for future relations. A significant number of individuals, 2/3 of the respondents, have formed opinions of various T&E installations prior to assuming their current position. A decision maker's evaluation of an installation's capabilities and expertise based partially on past memory contains an inherent danger. Past memory can be heavily influenced by one siginificant happening, good or bad, which occured during an individual's association with the activity and obscure the existing capability level of the facility.

<u>Question 8:</u> Staff assistance within a <u>Systems</u> <u>Command</u> is useful in determining the capabilities of T&E facilities.

1. Objective: Determine if a Project Manager receives assistance from his Systems Command on facility selection. It was thought that the Systems Command should perform a staff function of aiding a PM during his analysis of T&E requirements and installations capable of satisfying them. The Systems Command staff should act as an independent centralized information source on T&E facilities and, consequently,

supplement a PM's small staff with knowledgealbe personnel during the selection of a T&E facility.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	20	5.0%	55.0%	10.0%	25.0%	5.0%
VX'S	20	0	50.0%	35.0%	10.0%	5.0%
ALL	40	2.5%	52.5%	22.5%	17.5%	5.0%

	MEAN	MEDIAN
PM'S	2.700	2.318
VX'S	2.700	2.500
ALL	2.700	2.405

3. Conclusion: Some staff assistance is occuring at both the OPTEVFOR and Systems Command levels. Improved staff assistance might reduce the reliance on less than totally objective information presently being used by an individual. Information received from liaison offices, comtemporaries, and past assignments can fall into this category of "less than totally objective".

Question 9: There is a significant difference in costs to projects from T&E facilities offering comparable services.

1. Objective: This statement and the next was prepared to help investigate the role played by costs in selecting a T&E activity. From research done into the fiscal area of T&E, it is known that various installations can offer significantly different cost proposals. (The uniform funding policy established for the MRTFB does not define a uniform cost rate to be used. Uniform funding policy indicates who pays the overhead, and leaves the determination of direct labor and material rates to the individual activity.) Response to the question would indicate the awareness

of Project Managers and Project Officers to costs and indirectly the importance of costs in their selection. Queston 16 produces futher information on an individual's concern for cost proposals. Comparable services was used to emphasis that the the variances in costs were for similar work requests.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	21	19.0%	33.3%	38.1%	9.5%	0
VX'S	20	30.0%	30.0%	23.0%	15.0%	0
ALL	41	24.4%	31.7%	31.7%	12.2%	0

	MEAN	MEDIAN
PM'S	2.381	2.429
VX'S	2.250	2.167
ALL	2.317	2.308

3. Conclusion: A majority of those responding indicate their acknowledgement of substantial cost differences. What is interesting is the large percentage of no opinion registered to this statement. It is hard to conceive of stimulating a blank comment, no opinion, towards the question unless one is unconcerned with costs.

<u>Question 10:</u> Different funding techniques (NIF/RMS,etc) used by T&E facilities tend to mask the actual T&E cost of a project.

1. Objective: As discussed in Chapter 4 on financial management, costs paid by a PM could be either direct or total depending on what funding system, NIF or MRTFB, the installation is under. The funding method in relation to costs projected to a user is immaterial to Services and utlimately DoD, as the Defense Department must budget and pay for all costs.

If a Project Manager was not aware of these facts, he could be swayed to select a facility that on the surface was projecting the least cost, but has the greatest total costs. The reader is referred back to Chapter 4 Section 1 and the example of the five NIF activities' rate per hour to customers and total costs.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	21	38.1%	33.3%	23.8%	4.8%	0
VX'S	20	40.0%	25.0%	35.0%	0	0
ALL	41	39.0%	29.0%	29.3%	2.4%	0

	MEAN	MEDIAN
PM'S	1.952	1.857
VX'S	1.950	1.900
ALL	1.951	1.875

3. Conclusion: Most individuals are aware of the effects certain funding techniques have on masking the actual total costs incurred on a project to the DoD. There appears to be some inconsistency between the responses in this question and the last one on significant cost differences, especially from Project Managers. One would expect a higher no opinion response on a more sosphiscated statement such as this one, but the opposite happened. It is easier to explain a lack of knowledge in a specified area then to justify a lack of concern.

Question 11: Once a T&E facility has been chosen for a project a project manager has no latitude in altering the selection.

1. Objective: Once a selection was made designating a facility to perform certain T&E functions, it was not known if this selection could be

altered. Futhermore a doubt persisted as to the existence of Project Managers and Project Officers' authority to execute such altering. It was assumed that the change in T&E facilities was due to cause.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	20	10.0%	25.0%	5.0%	55.0%	5.0%
VX'S	20	5.0%	10.0%	40.0%	40.0%	5.0%
ALL	40	7.5%	17.5%	22.5%	47.5%	5.0%

	MEAN	MEDIAN
PM'S	3.200	3.682
VX'S	3.300	3.375
ALL	3.250	3.553

3. Conclusion: Selection of a T&E facility can be altered and a Project Manager does have the authority to execute the change. Responses from OPTEVFOR present a mixed picture as to the latitude of a Project Officer in changing T&E facilities. Approximately half believe they do possess the authority and the other half does not know, as represented in the no opinion percentage.

Question 12: As regards to facilities offering comparable services, there is a significant difference in the information feedback provided to a project manager to effectively monitor the progress of his project.

1. Objective: There presently exists varying forms of management information systems at T&E installations. A management information system should feed useful and timely data not only to those on the station but also to a PM, who is ultimately responsible for his project. It was not known if wide differences of quality existed in management information systems. The existence of a better information system which gives a Program Manager

improved control over his program, might persuade him to select and work with that facility. This could be especially important to a manager from the Washington area working with a distant facility.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	20	25.0%	30.0%	40.0%	5.0%	0
VX'S	20	15.0%	25.0%	40.0%	15.0%	5.0%
ALL	40	20.0%	27.5%	40.0%	10.0%	2.5%

	MEAN	MEDIAN
PM'S	2.250	2.333
VX'S	2.700	2.750
ALL	2.475	2.563

3. Conclusion: The objective was not met due to poor formulation of the question. Some believe good information systems do exist. Others did not know how to interpret the statement, as indicated by the large no opinion response.

Question 13: There is a significant difference in the technical expertise of T&E facilities offering comparable services.

1. Objective: T&E activities do offer similar functions and capabilities, but this does not give a complete picture of their ability to perform T&E. Personnel experience and reputation play an important role in the successful completion of a program. Do differences in technical expertise and reputation exist between two duplicate capability installations?

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	20	30.0%	45.0%	10.0%	15.0%	0
VX'S	20	20.0%	20.0%	30.0%	30.0%	0
ALL	40	25.0%	32.5%	20.0%	22.5%	0

	MEAN	MEDIAN
PM'S	2.100	1.944
VX's	2.700	2.833
ALL	2.400	2.269

3. Conclusion: At the Washington level a perception of different technical expertise strongly exists. In the minds of the Project Managers, some T&E facilities have superior personnel, and to take the results a step futher, superior quality of capabilities. OPTEVFOR projects a mixed feeling and no futher conclusion can be drawn.

Question 14: As regards to facilities offering comparable services, there is a significant difference in the ease of obtaining non-routine information on the progress of a project.

1. Objective: Apart from the periodic reporting on a project's status the Project Manager often has need for additional information not contained in these reports. Personal interviews have indicated some difficulty in obtaining non-routine information. In particuliar, some activities have more than one contact point for information concerning a project. This question was designed to measure the ease of obtaining non-routine information. Results could be useful in determining the overall coordination and communicative feedback existing within the activities.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	20	25.0%	25.0%	30.0%	20.0%	0
VX'S	20	25.0%	40.0%	35.0%	0	0
ALL	20	25.0%	32.5%	32.5%	10.0%	0

	MEAN	MEDIAN
PM'S	2.45	2.5
VX'S	2.1	2.125
ALL	2.275	2.269

3. Conclusions: This question appears to have raised a valid point since only ten percent of the respondents indicated disagreement. Interestingly enough, none of the VX respondents disagreed which may raise doubt as to facilities' overall cooperation with operational T&E units. Perhaps the lower rank of VX Project Officers in comparison with Project Managers might have an effect on the ease of obtaining non-routine information. Results from this question indicate that some facilities have done a better job of providiing information services to customers than others.

Question 15: Funding level for T&E facilities' modernization is adequate to support my project's needs.

1. Objective: Recent cuts in the Defense budget have resulted in the curtailment of modernization and expansion of T&E facilities. The effects of these cutbacks may have already begun to decrease T&E facilities' effectiveness in meeting a user's needs. This question was designed to evaluate the degree to which existing projects have been affected by a reduction in Defense spending.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	19	5.3%	36.8%	36.8%	10.5%	10.5%
VX'S	20	0	25.0%	40.0%	25.0%	10.0%
ALL	39	2.6%	30.8%	38.5%	17.9%	10.3%

	MEAN	MEDIAN
PM'S	2.842	2.714
VX'S	3.2	3.125
ALL	3.026	2.933

3. Conclusions: Overall, opinions on this question were evenly spread with VX respondents indicating some dissatisfaction with project support. Since there is no previous data to indicate how Project Managers/Officers felt in the past concerning funding adequacy no valid conclusions could be made as to whether cutbacks were significantly affecting program support.

__Question 16:__ Rank each of the following factors with respect to its importance in the facility selection process.

Cost Estimates
Personnel Expertise
Technical Capability
Logistics
Program Cooperation
Test Scheduling
Others (specify)

1. Objective: In selecting a T&E facility offering comparable services for his project a Project Manager presumeably considers the comparability between facilities for the identified parameters. Personal interviews indicate that a facility may tend to understate their cost estimates in order to attract additional business. In any event there may exist a wide spread difference between estimated and actual costs which would tend to diminish the credibility of cost estimates and consequently decrease its importance in the facility selection process. The logistics parameter is aimed at identifying to what extent a facility's geographical location and support services take in the selection consideration. The other parameters are indications of the quality of services provided which may vary extensively between facilities The objective of this question was to determine which parameters are most important to a Project Manager in considering facility selection.

2. Results:

FREQUENCY OF RANKING (1 = Most Important)

Selection Parameter	Selection Importance							
	1	2	3	4	5	6	7	MEAN
Cost Estimates	1	12	15	7	4	0	0	3.615
Personnel Expertise	6	18	3	7	5	0	0	2.667
Tecn. Capability	26	5	5	2	1	2	0	1.641
Logistics	2	1	5	7	9	15	0	4.667
Program Cooperation	3	4	10	8	7	6	1	3.872
Test Scheduling	0	4	5	6	10	10	0	4.486
Others	0	0	0	1	0	0	1	5.500

3. Conclusions: Respondents generally agreed that technical capability and personnel expertise were of primary importance. Cost estimates narrowly outranked program cooperation for the third highest ranking. Apparently logistics and test scheduling are of little importance compared to the other parameters. Two respondents provided additional parameters: one "unspecified", the other ranked "ability to simulate operational environment" fourth.

Question 17: Rank the following T&E facilities in their overall effectiveness in providing satisfactory services to Project Managers.

1. Most Effective - - - 8. Least Effective

A. Naval Weapon Center, China Lake
B. Pacific Missile Test Center, Point Mugu
C. Naval Air Test Center, Patuxent River
D. Armament Development and Test Center, Eglin AFB
E. White Sands Missile Range
f. U.S. Army Proving Grounds
G. Atlantic Fleet Weapons Range
H. Air Force Eastern Test Range, Patrick AFB

1. Objective: This question was designed to determine the image different T&E facilities project to potential users. The choice was limited to facilities capable of providing services to airborne weapon systems and hopefully the personnel surveyed would have some familiarity with or impressions of the effectiveness of the respective facilities. This question was not designed to determine a facility's actual effectiveness but merely to ascertain an idea of the reputation enjoyed by these facilities.

2. Results:

FREQUENCY OF EFFECTIVENESS RANKING

Relative Ranking by PM'S

	1	2	3	4	5	6	7	8	MEAN
NWC	7	2	2	1	1	0	0	0	2.231
PMTC	0	7	2	3	1	0	0	0	2.846
NATC	5	3	1	2	1	0	0	0	2.333
ADTC	0	0	2	0	2	0	0	0	4.0
WSMR	1	1	3	1	0	0	1	0	3.286
YUMA	1	0	1	0	0	1	0	1	4.5
AFWR	0	1	1	0	1	1	1	0	4.6
ESTR	1	0	0	1	0	0	1	1	5.0

Relative Ranking by VX-4

	1	2	3	4	5	6	7	8	MEAN
NWC	4	1	1	0	0	0	0	0	1.5
PMTC	1	1	2	0	0	0	0	0	2.6
NATC	1	1	2	0	0	0	0	0	2.250
ADTC	0	2	1	0	0	0	0	0	2.333
WSMR	1	1	0	1	0	0	0	1	4.667
YUMA	0	0	0	0	0	1	0	0	6.0
AFWR	0	0	0	0	0	0	1	0	7.0
ESTR	0	0	0	0	1	0	0	0	5.0

Relative Ranking by VX-5

	1	2	3	4	5	6	7	8	MEAN
NWC	9	2	0	0	0	0	0	0	1.182
PMTC	1	6	1	2	0	0	0	0	2.4
NATC	1	0	2	1	1	0	0	0	3.375
ADTC	1	0	2	1	1	0	0	0	3.250
WSMR	0	1	1	1	0	0	0	0	3.0
YUMA	0	1	0	0	0	1	0	0	7.333
AFWR	0	1	0	0	0	1	1	1	5.750
ESTR	0	0	0	0	0	1	2	0	6.667

Overall Relative Ranking

	1	2	3	4	5	6	7	8	MEAN
NWC	20	5	3	1	0	0	0	1	1.7
PMTC	2	14	5	6	1	0	0	0	2.643
NATC	7	4	7	3	2	1	0	0	2.667
ADTC	1	2	5	1	3	0	0	0	3.250
WSMR	1	3	4	3	0	0	1	1	3.538
YUMA	1	0	1	0	0	3	0	3	5.750
AFWR	0	2	1	0	1	2	3	1	5.3
ESTR	1	0	0	1	1	1	3	1	5.625

3. Conclusions: Overall, NWC, China Lake was clearly the most popular facility. Even VX-4 which is stationed at Point Mugu and primarily uses facilities of PMTC preferred NWC to PMTC. If familiarity caused an unfavorable bias towards a particuliar facility this did not reduce VX-5'S ranking of NWC below number one spot. It is of no suprise that the Navy facilities rated highest since respondents were mostly Naval Officers. It may be worthwhile for facilities to follow-up on these results and find out what makes other facilities more appealing to potential users.

Question 18: Increased competition among T&E facilities would increase the effectiveness of services provided to project managers.

1. Objective: In commercial enterprises competition has traditionally benefitted customers since it inherently fosters more efficient and effective services. In the military, however, an increase in duplicative functions may not be feasible due to political considerations. This question was designed to survey the opinions of users considering both the benefits derived from increased competition as well as their feelings about such a politically unpopular proposal.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	20	10.0%	25.0%	15.0%	30.0%	20.0%
VX'S	20	15.0%	25.0%	45.0%	45.0%	10.0%
ALL	40	12.5%	25.0%	10.0%	37.5%	15.0%

	MEAN	MEDIAN
PM'S	3.25	3.5
VX'S	3.1	3.611
ALL	3.175	3.567

3. Conclusions: In general, respondents did not favor increased competition as a viable means of increasing effectiveness of services. If a majority disagreement had been anticipated it would have been worthwhile to ask "why not ?". It may be that respondents consider outright competition in the military as an infeasible concept.

Question 19: Competition among T&E facilities should be eliminated in order to reduce the additional cost of overlapping capabilities.

1. Objective: Related to the previous question this one was designed to solicit opinions for total elimination of competition due to cost considerations. Hopefully the respondent would weigh the benefits derived from competition as it presently exists against the increased cost of overlapping capabilities.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	20	25.0%	35.0%	0	30.0%	10.0%
VX'S	20	10.0%	45.0%	15.0%	30.0%	20.0%
ALL	40	17.5%	40.0%	7.5%	25.0%	10.0%

	MEAN	MEDIAN
PM'S	2.65	2.214
VX'S	2.7	2.389
ALL	2.7	2.313

3. Conclusions: Overall, respondents opposed to increased competition were in favor of reduced competition. The results may have been affected by present public concern over wasteful military spending. It is questionable whether or not elimination of competition would be financially beneficial in the long run.

Question 2C: Selection of a contractor influences the selection of a T&E facility.

Objective: Basically self explanatory, this question was designed primarily to determine if a contractor's geographical accessibility to a facility or preference to have a particuliar facility perform the T&E has any influence over the actual selection.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	21	0	14.3%	14.3%	57.1%	14.3%
VX'S	20	10.0%	20.0%	40.0%	25.0%	5.0%
ALL	41	4.9%	17.1%	26.8%	41.5%	9.8%

	MEAN	MEDIAN
PM'S	3.714	3.875
VX'S	2.950	3.0
ALL	3.341	3.529

Conclusions: Although most respondents had no opinion or disagreed it is interesting that at least some respondents felt contractors do have an influence. It may be worthwhile for facilities to determine in what situations or for which contractors, contractor selection has an influence.

Question 21: DCPs are overly restrictive in their testing requirements and thus limit the Project Manager's selection to one T&E facility.

1. Objective: This question had a two-fold objective. One was to determine the degree of confinement placed on the PM by the DCP or if he was permitted to utilize various facilities and make an effective managerial decision. If the DCP were to clearly dictate one T&E facility, other factors would become unimportant. Additionally, it was hoped to gain some more insight as to the uniqueness of the missions of each facility and degree of overlap. It would also help to isolate the point of time in the planning cycle when a facility seemed destined to get the project.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM's	21	9.5%	9.5%	33.3%	42.9%	4.8%
VX'S	20	0	10.0%	5.0%	35.0%	5.0%
All	41	4.9%	9.8%	41.5%	39.0%	4.9%

	MEAN	MEDIAN
PM'S	3.238	3.429
VX'S	3.350	3.300
All	3.293	3.353

Conclusions: Although the question received a large number of " no opinion ", there appears to be general agreement that most DCPs do not dictate the use of one particular facility. The large non-committal population may indicate that DCPs are restrictive enough to indicate the use of a particular facility but nebulous enough that an aggressive PM could easily justify the use of other facilities. It appears that in regards to satisfying the requirements of a DCP that there is considerable overlap in missions of the various facilities as interpretted by the user.

Question 22: Weapon systems T&E requirements are identified early enough to permit funding justification for facility modernization.

1. Objective: With the advent of the NIF and MRTFB funding system, T&E facilities will undoubtedly become more cost-conscious in the selection of internal improvements, i.e. only those which will earn them an effective rate of return. The resulting capability uniqueness may require a greater time period in which to prepare for the T&E requirements of a project. It is therefore imperative that these requirements be identified early in the planning cycle so as not to cause delays later on. Although it must be recognized

that due to the relative short period of time since the introduction of NIF into T&E facilities that this uniqueness may just be developing, it was desired to get a current basis for the lead-time problem.

2. Results:

	Responses	S.A.	A.	N.O.	D.	S.D.
PM'S	21	0	38.1%	14.3%	38.1%	9.5%
VX'S	20	0	15.0%	30.0%	30.0%	25.0%
ALL	41	0	26.8%	22.0%	34.1%	17.1%

	MEAN	MEDIAN
PM'S	3.190	3.333
VX'S	3.650	3.667
ALL	3.415	3.536

3. Conclusions: Although the PMs appear pretty evenly split over this issue, the VX Project Officers appear to be currently experiencing some problems in this area. T&E facilities may be more in tune to the DT&E aspects of programs than to the OT&E requirements of OPTEVFOR. Additionally, personal interviews with VX Project Officers indicated that schedule slippage during DT&E often caused a compression of time allotted for OT&E.

<u>Question 23:</u> T&E facilities are consistent in their method of assigning project priorities for completion.

1. Objective: Although OPNAV instructions provide general guidance for the assignment of project priorities, it was desired to ascertain such things as if perhaps small projects received less priority than large continuing projects as a result of the financial impact on the facility. It was also desired to know if a project could expect equal treatment at several facilities based solely on the merits of the project.

2. Results:

	Responses	All	Most	Some	Few	None
PM'S	17	0	29.4%	23.5%	41.2%	5.9%
VX'S	19	0	42.1%	31.6%	15.8%	10.5%
ALL	36	0	36.1%	27.8%	27.8%	8.3%

	MEAN	MEDIAN
PM'S	3.235	3.375
VX'S	2.947	2.750
ALL	3.083	3.000

3. Conclusions: VX Project Officers appear to receive more consistent(good or bad) treatment as regards their project priorities. Project Managers tend to disagree that there is a consistent method of assigning priorities. Perhaps one factor in this is the existence of long-term working relationships between various PMs and specific facilities.

<u>Question 24:</u> T&E facilities show a genuine interest in providing program support for successful completion of the project.

1. Objective: This question was designed to determine the type of environment a PM finds himself in after contracting with a facility. Do they follow through with services promised? Are they interested in his project problems and thus provide the "extras" beyond the requested tests? Are facilities more interested in acquiring new projects than completing the ones they have?

2. Results:

	Responses	All	Most	Some	Few	None
PM's	19	26.3%	42.1%	26.3%	5.3%	0
VX'S	19	15.8%	47.4%	21.1%	15.8%	0
ALL	38	21.1%	44.7%	23.7%	10.5%	0

	MEAN	MEDIAN
PM'S	2.105	2.063
VX'S	2.368	2.222
ALL	2.237	2.147

3. Conclusions: Although the term "program support" may not have been adequately defined, most respondents seem pleased with the cooperation they receive with their projects. VX Project Officers may not receive the same degree of support in that their projects are often grouped together under the cognizance of one program manager at a facility due to their limited requirements.

<u>Question 25:</u> Deficiencies noted by the PM in a project's progress are examined and corrected by the T&E facilities.

1. Objective: This was designed to indicate the degree of flexibility of a facility and also its willingness to accept constructive criticism by the user. It was felt that the user should be assured that his viewpoint would be listened to and not dwarfed by the magnitude of the T&E business. Additionally, facilities should have a system by which these deficiencies may be reviewed and erradicated.

2. Results:

	Responses	All	Most	Some	Few	None
PM'S	20	10.0%	45.0%	20.0%	20.0%	5.0%
VX'S	18	0	33.3%	27.8%	38.9%	0
ALL	38	5.3%	39.5%	23.7%	28.9%	2.6%

	MEAN	MEDIAN
PM'S	2.650	2.389
VX'S	3.056	3.100
ALL	2.842	2.722

3. Conclusions: The results somewhat parallel that for program support. VX Project Officers, expectedly, do not feel they have the power to cause a change in deficient areas at many facilities. PMs adopting a more strongly-opinionated(all or none) stand than VX Project Officers on this issue is an interesting reversal to the normal trend noted in other questions.

<u>Question 26:</u> T&E facilities capable of providing services for my project have shown eagerness for my project.

1. Objective: Eagerness for a project may be shown in a number of ways. Two noticeable ways are through liaison and scheduling. Reference (31) indicated that the "marketing" effort of the T&E facilities varied considerably. NWC was cited as having a very well-organized, well-run liaison group in the Washington area. It was desired to ascertain how many of the facilities were able to impress the managers of their interests in obtaining projects through their liaisons. Eagerness for involvement may also be detected by the ease in which PMs can coordinate the scheduling of services with a facility.

2. Results:

	Responses	All	Most	Some	Few	None
PM'S	20	35.0%	30.0%	25.0%	10.0%	0
VX'S	19	10.5%	42.1%	26.3%	10.5%	10.5%
ALL	39	23.1%	35.9%	25.6%	10.3%	5.1%

	MEAN	MEDIAN
PM'S	2.100	2.000
VX'S	2.684	2.438
ALL	2.385	2.250

3. Conclusions: Due to the relative difference in dollar value, it is probably not surprising that the PMs experienced a greater eagerness from the facilities than did the Project Officers of the VX squadrons. What is particularly noteworthy is that no PM answered "none", which seems to indicate that facilities are not saturated with projects to the point of not wanting to compete for new projects.

Question 27: T&E facilities actively participate in the selection process of weapon system test assignment.

1. Objective: This question was designed to measure the current extent of " marketing " on the part of T&E facilities. Although some of the data on the capabilities of the facilities are tabulated in the various references cited earlier, it was recognized that many tests require very unique utilization of equipment. Since PM staffs are limited in size it appeared that additional aid must come from both within NAVAIR and the facilities. T&E facilities themselves seem most highly qualified to tell the managers what they can do for them.

2. Results:

	Responses	All	Most	Some	Few	None
PM'S	18	16.7%	11.1%	44.4%	11.1%	16.7%
VX'S	18	0	27.8%	27.8%	33.3%	11.1%
ALL	36	8.3%	19.4%	36.1%	22.2%	13.9%

	MEAN	MEDIAN
PM'S	3.000	3.000
VX'S	3.278	3.300
ALL	3.139	3.115

3. Conclusions: Perhaps the term "actively participate" required better definition. The results seem to indicate, however, that there is not a lot of current involvement on the part of the facility. While this may be good from the standpoint of obtaining an independent decision, it seems that an important source of information remains untapped.

<u>Question 28:</u> What is your rank/GS level?

1. Objective: The objective was fairly straightforward. It was desired to ascertain this information in order to have the ability to correlate data from any qustion by groups according to rank. This also served as a check to see if the questionnaire had been filled out by the decision maker and thus reflected his opinions or delegated to some other individual.

2. Results:

	RESPONSES	03	04	05	06	07	08	GS9	GS14	GS15
PM'S	20		1	2	11	1	1	1	1	2
VX'S	19	10	7	2						
ALL	39	10	8	4	11	1	1		1	2

3. Conclusions: It appeared that most questionnaires were completed by the decision maker or by high level staff assistants and thus it was assumed that they accurately reflected the thought process behind the selection process.

Question 29: Highest level formal education achieved.

1. Objective: As in the previous question additional background information was desired. Coupled with question number 30, it provides valuable insight on the backgrounds of these very important decision makers.

2. Results:

	RESP	AA	BS/BA	MS(TECH)	MS(NON-TECH)	DOC	DUAL/MS
PM'S	20	0	25.0%	50.0%	15.0%	5.0%	5.0%
VX'S	19	0	73.7%	15.8%	5.3%	5.3%	0
ALL	39	0	48.7%	33.3%	10.3%	5.1%	2.6%

3. Conclusions: As might be expected, most PMs held a Masters Degree in a technical area and their more junior counterparts in VX squadrons held BS/BA Degrees. All respondents held the equivalent of a Baccalaureate or higher. It is noteworthy to observe that few respondents held Masters degree in non-technical areas even though a large percentage of their effort may be in management.

Question 30: Number of years involved in T&E assignments.

1. Objective: As in question 28 and 29 additional background information was desired.

2. Results:

	RESPONSES	0	1	2	3	4	5	6	9	10	15	25
PM'S	20	4		1		4	4	2	1	2	1	1
VX'S	19		7	9	2	1						
ALL	39	4	7	10	2	5	4	2	1	2	1	1

	MEAN	MEDIAN
PM'S	12.15	6.000
VX'S	1.842	1.778
ALL	7.128	3.600

3. Conclusions: Question 7 indicated a high reliance by PMs on their previous experience and assignments. The results of this question does not, however, indicate an abundance of previous experience in T&E assignments. On the contrary, it seems to indicate a definite need for a strong liaison between the " experts in T&E " and the PM who in many respects is acting as a corporate manager.

C. RESULTS AND CONCLUSIONS

The response received from the questionnaire was excellent. Preliminary expectations, based on opinions of marketing experts, forecast a completed return of 30-50% of all questionnaires sent out with possible increases obtainable from additional follow-up. The survey produced, however, an overall response of 75%. This tremendous response seems to indicate a high degree of interest and concern in the areas covered by the questionnaire. It is also noteworthy that the questionnaires appeared to have been thoughtfully filled out by the decision makers, themselves, as indicated by the rank profile.

Questions 3 and 22 failed to clearly establish the degree and type of urgency experienced at the VX level. Although the Project Officers did not feel limited to one facility as a result of the urgency of their project, most agreed that the urgency prevented adequate time for facility modernization and improvements to complete the T&E.

Questions 1,2,3, and 21 attempted to ascertain if and why PMs might be limited to one facility. Over 60% of all respondents felt that more than one facility was able to provide the services they required. Of those constrained to one facility, technical constraints was the major cause. At

the PM level, urgency contributed substantially to the remainder with limitations of an overly-restrictive DCP being relatively minor.

Questions 1, 18, 19, and 26 all addressed the area of competition. Results indicate that a competitive environment does exist and installations appear to be eager for more business. Competition among facilities as viewed by the Project Managers and Project Officers is not favored and should be reduced. Futhermore, it appears the managers believe that by not only reducing but by eliminating competition, i.e., do away with installations' overlapping capabilities, costs of T&E could be lowered.

Results of question 17 indicate that Project Managers/Officers perceive a difference in the effectiveness of various T&E facilities. Results of personal interviews by PMTC personnel contained in Reference 31 indicate that NWC, China Lake, had a better liaison group and were easier to work with during project assignments. Question 17 substantiated these opinions since NWC enjoyed a position of number 1 in the eyes of the users. Perhaps the key for facilities to improve Project Managers' perception of their effectiveness would be to exert more effort towards formulating a closer working relatioship with Project Managers.

Responses to the three cost questions, 9, 10, and 16, appear to indicate some significant facts. Cost estimates are not the number one factor in importance for selecting a facility. Most managers are aware of the masking effect different funding techniques have on total costs incurred. The disturbing feeling caused by a 38% no opinion response on question 9 might just be explained by the results given in questions 10 and 16. Managers in 16 appear to express a lack of creditability in cost estimates proposed by the

facilities for T&E projects. This attitude coupled with the clouding of true costs by the different accounting techniques might generate within managers a feeling of confusion and disinterest towards the fiscal area.

Question 16 addressed the area of facilities' selection criteria. As mentioned, cost considerations did not receive the importance anticipated. Technical capability was clearly considered the most important parameter in the selection process. Question 13 pointed out that 75% of the Project Managers felt there existed a significant difference in the technical expertise of T&E facilities offering comparable services. The next section will address this area and propose a method of objectively rating the various facilities based on their technical capabilities.

VI. EFFECTIVENESS ANALYSIS

Results of the questionnaire indicate that for many weapon systems: more than one T&E facility was capable of fulfilling the T&E requirements for a particular project. Results also indicated that technical capability was the most important parameter in selection of a facility to perform a weapon system's T&E. There now exists, within DoD, 26 major T&E facilities, many of which are capable of fulfilling the T&E requirements of a specific project. To the best of the authors' knowledge, no method presently exists to objectively appraise the technical suitability of these facilities for a particular project.

This chapter will address the question of which T&E facility is most technically capable of fulfilling the T&E requirements of a particular project. Solution to the question is addressed through use of a systems analysis format (statement of objective, assumptions, and measure of effectiveness). Through a systems analysis approach this chapter demonstrates an objective method of selecting the appropriate facility for a particular weapon scenario. In particular, this chapter presents a functional capabilities measurement of those T&E facilities capable of providing T&E to projects involved in aircraft/weapon systems.

The functional capabilities of the selected facilities is quantified based on an appraisal of qualitative data. The data was based on the results of recent trips conducted by PMTC personnel to appraise the technical capabilities of other T&E facilities. It must be emphasized that cost considerations are ignored and that technical capabilities are the prime considerations in the analysis.

A. OBJECTIVE

The objective of this analysis is as follows:

> "Selection of the facility most capable of satisfying the T&E requirements of an aircraft/missile weapon system in a capability restrained environment."

1. Limitations

Rarely, if ever, does one facility possess all the equipment/technical capability required to meet the needs of a specific project. This paper limits its analysis to selection of the facility which can perform the majority of the services based upon current resources. In order to overcome this limitation a project manager has two major alternatives:

a) Additional funding for facility capability expansion.

b) Selection of secondary facilities capable of providing the specific tests not available at the primary facility.

The restriction of the weapon system to aircraft/missile is necessitated by the limitations of data available. Point Mugu, whose primary mission is the T&E of airborne weapon systems, is the prime scource of data.

B. ASSUMPTIONS

1. One T&E facility is the "prime contractor"

As mentioned previously no one facility has all the resources available to meet the total requirements of a project. Normally one (lead) facility handles the majority

of the T&E requirements and farms out to "subsidiary" facilities specific tasks under the cognizance of the Project Manager.

2. <u>More than one facility can satisfy the T&E requirements of a project.</u>

Although the upper echelon executives of DoD may claim that there is little duplication of capabilities within the Department this is not so. It cannot be denied that some weapon systems are so unique that the T&E requirements can only be met by one facility. It is not these particular systems to which this study is directed. The survey conducted by the authors indicates that many Project Managers feel that more than one facility was capable of meeting the T&E requirements of his project. The survey was used to make an assessment of the T&E process currently employed by the Project Manager. A copy of the survey is included as Appendix B. Results are analyzed in Chapter V. Section B.

3. <u>Project Manager's selection not subject to non-functional constraints.</u>

This analysis presupposes that a Project Manager's selection criterion is based solely on functional capabilities. Other overriding considerations may limit a Project Manager's selection to a less functionally suitable facility. Cost limitations may restict selection to a facility which can provide only marginal service. The optimum facility may not be able to accept another project due to a backlog of work assignments. Political pressure beyond a Project Manager's control may force selection of a suboptimal facility including pressure from higher authority. A Project Manager may consider additional capabilties more important in the selection.

4. Project Manager is motivated to find the optimal facility for his T&E needs.

It is assumed that the Project Manager is willing to use an objective criterion in selecting a facility to satisfy his future T&E requirements. The survey conducted indicates a high dependence on familiarity of facilities from previous assignments as a selection criterion. Personal interviews conducted with Project Officers show that some Project Officers felt quite adament about using the same T&E facility they've used in the past and no matter what the capabilities of other facilities are they would continue to use the same facility in the future. Here it is recognized that preconceived notions have an affect on making an objective decision and that a certain degree of bias cannot be avoided.

5. Project within the cognizance of NAVMAT

Analysis will be limited to those projects identified strictly as Navy projects under the purview of the Navy Material Command (NAVMAT). This avoids analysis of joint projects which are concurrently developed by more than one service. The authors' unfamiliarity with Air Force/Army procurement particulars preclude their inclusion.

6. Costs are not considered in selection.

Although it would be unreasonable to assume that costs should be ignored in the selection process the survey indicates that technical capability significantly outweighs considerations of cost estimates in the selection decision. Project Managers also agree that the different funding techniques used in T&E funding tend to mask the actual costs of a project.

Since a cost analysis is not feasible at this time it must be recognized that the computer program does not utilize cost as a parameter. In particular, funding at T&E facilities is in a transitional stage due to the recent enactment of the Uniform Funding Policy (1974) and the instituting of RIF at these activities.

7. Paraochialism should not be a selection criterion

The feeling that Navy projects should go to Navy facilities should not be allowed to creep into an objective selection criterion. Although facilities may have priority methods that favor their individual Service this consideration should be dealt with after an objective decision has been made.

C. DEVELOPMENT OF MODEL

In order to provide a basis for relating the many aspects of capability assessment it is necessary to establish some common denominator. A common denominator which satisfies the requirement for this application is a set of functional capabilities. Investigation into PMTC tasks and interviews conducted led to a determination of the set of 26 mutually exclusive members as developed in Reference 32. This set is intended to exhaust the capabilities of a Test & Evaluation activity, including an orgranization as large as PMTC, in terms of functions/services.

The 26 functions are:

1. Trajectory- Provide precision position measurements in space, air, surface, and underwater by active or passive

electromagnetic means, optical means, or acoustical means. This includes radar, optics, underwater tracking, missile impact location systems, LORAC, and passive tracking systems.

2. Telemetry- Provide for the collection and display of engineering parameters such as onboard inertial data, environmental data, scalar miss distance, and other performance data by passive electromagnetic means.

3. Command Control- Provide command control, including flight termination control of vehicles and missiles, and the remote control of targets and unmanned vehicles.

4. Geophysics- Provides environmental data, including geodetic surveys and meteorological and oceanographic measurements.

5. Frequency Management- Provide coordination, monitoring, and engineering services for electromagnetic frequencies within assigned areas. This function includes command frequency management, operation frequency support, and area frequency coordination.

6. Photography- Provide photographic, television, and technical services required to support the documentation and surveillance of events occurring at and about the field activity and the test range as well as the instrumentation support of static and dynamic ground and airborne testing and evaluation activities.

7. Launching- Provide launching of missiles, test vehicles, and targets and the ground support including ordnance for launched systems.

8. Recovery- Provide air, surface, and underwater

location and retrieval services.

9. Operational Communications- Provide necessary tele-commprovide capability to conduct and control, and display data for all operations. unication systems for the conduct of operations.

10. Operational Control- This includes range surveillance and clearance, tactical data and real-time display, timing, range safety, range control, and range scheduling.

11. Threat Simulations- Provide support to the weapons systems acquisition programs for developing, testing, and evaluation aerial and surface targets simulating realistic threat environments.

12. Technical Services- Provide prototype fabrication, modifications, repairs, calibration, acceptance tests, and tenant range services and depot level maintenance to existing equipment and provide open shop computer services for all authorized external requestors.

13. Internal Technical Services- All effort internal to the activity, but not directly identifiable with the above functional categories. This effort will be prorated to the functions: trajectory through threat simulations.

14. Facilities/Utilities Support- Provide for the maintenance and repair of roads, buildings, grounds, and equipment, and the provision of utility services including water, power, telephone, and waste collection and disposal systems.

15. Logistics- Provide for supply support services and the operation and maintenance of systems which transport

material and personnel by land, sea, or air. Provide nesessary engineering, management and technical services to maintain and support integrated logistic support plans for assigned equipment.

16. Air Operations- Provide for the operation and maintenance of all-weather airfields including fire fighting and crash crew support, flight support services including air traffic control, fueling, other line maintenance and air terminal; and search and rescue.

17. Military Community Services- Provide services such as senior officer present/area coordinator, legal, chaplain, dental, recreation, family housing, bachelor enlisted quarters, bachelor officer quarters, and clubs for military personnel.

18. Security- Provide for the administration and maintenance of a security program for physical security, law enforcement, disaster control, and classified material control.

19. Non-operational Communications- Provide for the administration, operation, and maintenance of long range and fixed point-to-point telecommunications.

20. Administration and Management- This function includes all Command Staff functions involving resource and program management, personnel and financial support services, managment systems and data processing

21. Threat Assessment- Provide for the acquisition, analysis, and assessment of performance and characteristic data on aerial target and threat systems and the determination of the requirements, capabilities, and applications of aerial targets systems for simulated

threats. Support to the aerial target user community with technical information concerning the translation of threat parameters and weapon system T&E plans to specific target requirements.

22. Software Support- Provide for the management, functional, and technical support of all computer programs, independent of their storage media, associated with airborne weapon systems, and related design, analysis, and documentation.

23. Weapon Systems Test and Evaluation- Provide the operational planning, preparation of equipment and resources, and performance of engineering ground and airbrone testing in static, dynamic, integrated, or simulated modes to acquire pertinent data to be analyzed for evaluation of procedures, processes, capabilities, and characteristics of weapon systems. The determination of design, operational, and compatibility limitations or deviations as they effect the development and production decisions in the weapon systems acquisition cycle.

24. Production Support- Provide the aggregate of engineering assistance required by a cognizant field activity in support of an ongoing production program involving equipments for which it has been assigned engineering cognizance.

25. Engineering Services- Provide basic engineering services for design, development, test and evaluation, and product quality assessment in support of the development, production, and operational phases of weapon systems. The services include engineering consideration of compatibility, safety, reliability, maintainability, and performance to establish the value of the weapon systems.

26. <u>Aircraft Maintenance Department</u>- Provide intermediate level maintenance on all aircraft assigned to the facility, contractor bailed aircraft, tenant activities, and transient aircraft; and to provide organizational level maintenance to the activity aircraft, and transient aircraft.

There are 26 major T&E/range facilities able to act as the lead activity in a weapon system T&E program. These are identified in DoD Directive 3200.11 of June 18, 1974.

1. National Ranges. Those major DoD ranges and test facilities which are unique national assets designed to support requirements of major DoD programs.

<u>National Ranges</u>	<u>Services</u>
White Sands Missile Ranges	USA
Kwajalein Missile Range	USA
Pacific Missile Test Center	USN
National Parachute Test Range	USN
Eastern Test Range	USAF
Space and Missile Test Center	USAF
Satellite Control Facility	USAF
Arnold Engineering Development Center	USAF

2. DoD Major Test Facility. Those other major DoD test facilities which support, almost entirely, DoD requirements.

<u>Test Facilities</u>	<u>Services</u>
Dugway Proving Ground	USA
Arctic Test Center	USA
Tropic Test Center	USA
Yuma Proving Ground	USA
Jefferson Proving Ground	USA
Electronic Proving Ground	USA

Aberdeen Proving Ground	USA
Atlantic Underwater T&E center	USN
Naval Air Test Center	USN
Naval Air Propulsion Test Center	USN
Naval Air Test Facility	USN
Naval Weapon Center	USN
Atlantic Fleet Weapon Range	USN
Air Force Special Weapons Center	USAF
Tactical Fighter Weapon Center	USAF
Air Force Flight Test Center	USAF
Armament Development Test Center	USAF
Air Defense Weapon Center	USAF

Not all 26 facilities are capable of supporting similar weapon systems T&E, but are restrained to one or more differentiable categories such as air related systems, ballistic missiles, ordnance, and climatic tests. Consideration of an activity for T&E work is limited in scope to those organizations with related mission statements, technical capabilities, and expertise in the broad weapon systems classes.

One particular segment of activities renders T&E support of some degreee towards aircraft/missile related systems. It is this general weapon system area and corresponding T&E activities that forms the boundary of alternatives available for this particular selection analysis. This particular area of selection was predicated on availability of information from a T&E activity within this segment, PMTC. Of the 26 major T&E/range facilities 13 of them perform functions similar to PMTC.

Table I is a matrix representing the 26 functional capabilities and the 14 similar/competing activities. Existing capability is indicated by an x and a lack is represented by a blank space.

Severe data and quantitative measurement limitations are evident in attempting to rate a possible 26 functional capabilities at 14 competing facilities. It was mandatory to further reduce the number of similar T&E activities available to a Project Manager for selection to the ones whose functions have been examined. Information was obtained on seven of the fourteen organizations. The seven activities are: PMTC, Armament Development and Test Center (ADTC), Eglin AFB, Naval Air Test Center (NATC), Patuxent River, Atlantic Fleet Weapon Range (AFWR), Roosevelt Roads, Yuma Proving Grounds, Naval Weapon Center (NWC), China Lake.

Determination of a quantitative measuring technique for evaluating activities' functions was discovered to be impractical. The amount of technical expertise and T&E experience needed to understand the various 26 functions coupled with the lack of a common capability comparison data base among facilities precluded the utilization of a quantitative measuring method.

A qualitative rating scheme was substituted. The scheme was developed by having individuals (at PMTC) familiar with T&E and its respective facilities render a judgement, subjective in nature, upon those activities' functional capabilities (Ref. 33). Credance in their evaluation is centered upon two known facts. The first element is the individual's experience in T&E and his present work function as a program analyst. The second item is the recent completion of field trips to the six identified orgranizations, excluding PMTC by a team from PMTC.

FACILITIES

CAPABILITIES	PMTC	NWC	SAMT	ADTC	ESTR	WSMR	AUTE	NATC	KWAJ	AFWR	AFFT	YUMA	AFSC	TPWC
Trajectory	x	x	x	x	x	x	x	x	x	x	x	x		x
Telemetry	x	x	x	x	x	x		x	x	x	x	x	x	x
Command Control	x	x	x	x	x	x			x	x	x	x		x
Geophysics	x	x	x	x	x	x	x	x	x	x	x	x		
Frequency Management	x	x	x	x	x	x		x		x	x	x		x
Photography	x	x	x	x	x	x	x	x	x	x	x	x		x
Launching	x	x	x	x	x	x	x		x	x	x	x		
Recovery	x	x	x	x	x	x	x	x	x	x	x	x		
Operational Communications	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Operational Control	x	x	x	x	x	x	x	x	x	x	x	x		x
Threat Simulation	x	x	x	x		x	x			x	x	x		
Technical Services	x	x	x	x	x	x	x	x		x	x	x		
Internal Technical Services	x	x	x		x			x		x		x		
Facilities/Utilities	x	x	x	x	x	x	x	x	x	x	x	x		x
Logistics	x	x	x	x	x	x	x	x	x	x	x	x		x
Air Operations	x	x	x	x	x	x		x		x	x	x		x
Military Community Services	x	x	x	x	x	x		x		x	x	x		x
Security	x	x	x	x	x	x	x	x	x	x	x	x		x
Non-Operational Communications	x	x	x	x	x	x	x	x	x	x	x	x		x
Administrative & Management	x	x	x	x	x	x	x	x		x	x	x	x	x
Threat Assessment	x	x	x	x		x		x		x				
Software Support	x	x	x	x	x			x	x	x			x	
Weapons Systems T&E	x	x	x	x		x	x	x		x	x	x		x
Production Support	x	x	x	x		x		x		x		x		
Engineering Services	x	x	x	x	x	x		x				x		
Aircraft Maintenance	x	x	x	x	x	x		x		x		x		x

Table I. Facility Capability Matrix

"X" denotes existence of capability at above facilities.

The team was asked to apply a qualitative rating scale consisting of four categories; better, average, worse, or, no capability, to each of the functions present at the facilities visited. Average was defined as the typical level of capability existing for a specified function after surveying all the facilities; due to the subjectivity of the investigation, no one activity should necessarily represent the average. Better and worse classifications were easily perceived by the team relative to the average. A modified ordinal scale was selected as the "yardstick" best suited to a subjective qualitative rating technique. A cardinal scale, representative of a quantitative scale with well defined intervals, could not be adapted to a judgemental rating scheme.

An arithmetic method was needed for the transformation of a qualitative ranking into a numerical score. The ordinal scale easily adapted itself to a numerical scoring process and values of 0 to 3 were assign to the 4 classes in this order: 0 no capability, 1 worse, 2 average, and 3 better. Transformation from a qualitative to numerical scoring permits the utilization of a crude measure of effectiveness, (MOE). A MOE is necessary for satisfying the requirements of assigning weighting factors to the 26 functional capabilities; and, to reach a conclusion as to the overall standings of the alternative activities.

Utilization of this MOE was permitted only after recognizing three existing limitations: its subjectivity, lack of a well defined interval to determine how much better is better from average and average from worse, and a rater's biasing. Personnel rendering their opinion on the seven facilities' functional capabilities are members of PMTC and as such may have some presuppose tendencies towards favoring PMTC. The ordinal value points assigned gives only an

opinion as to the relative position of the specific functions at one activity to the others. It does not indicate the degree of satisfication of a test requirement which might be obtained at the facility.

Subjective rating scores of the various activities' functional capabilities by the visiting team are listed in table II. The qualitative judgement scheme used prohibits any futher computational analysis of the scores, excluding totalling the points, such as determining a numerical mean either by function or overall.

Actual assignment of value points to the capability matrix were by necessity qualitative in nature. Within a functional element it is felt that consistency exists; i.e., relative difference in a functional capability between facilities with assigned values of 2 and 3, respectively, is approximately the same as between facilities with assigned values of 1 and 2, respectively. However within an activity it is difficult to justify whether the assignment of a 1 or 2 in one function is analogous to awarding a 1 or 2 to another function. Since the availability of data constrains the research to this form of information, an assumption is made that a well defined ratio exists between functional capabilities' assigned value points. Sensitivity analysis may justify or preclude this assumption.

CAPABILITIES	PMTC	AFWR	ADTC	NATC	NWC	YUMA	WSMR
	FACILITIES						
Trajectory	2	1	3	1	1	2	2
Telemetry	2	1	2	3	1	1	2
Command Control	3	2	2	0	1	1	2
Geophysics	2	1	2	2	1	1	2
Frequency Management	2	3	2	1	1	1	2
Photography	2	1	3	2	2	1	2
Launching	3	1	2	0	2	1	2
Operational Communications	3	2	2	1	2	1	2
Operational Control	3	2	2	1	2	1	2
Recovery	2	2	2	2	1	1	1
Threat Simulation	3	2	2	0	1	1	2
Technical Services	2	1	3	2	2	1	1
Internal Technical Services	2	2	2.	2	2	2	2
Facilities/Utilities	2	2	2	2	2	2	2
Logistics	2	2	2	2	2	2	2
Air Operations	2	1	3	3	2	1	2
Military Community Services	2	1	3	2	2	2	2
Security	3	2	1	2	1	1	2
Non-Operational Communications	2	1	2	3	2	2	2
Administrative & Management	2	2	2	2	2	2	2
Threat Assessment	2	1	2	1	1	0	1
Software Support	3	1	2	2	1	0	0
Weapons Systems T&E	2	1	3	1	2	1	2
Production Support	2	1	2	2	2	0	1
Engineering Services	3	0	3	2	3	1	2
Aircraft Maintenance	2	2	3	3	2	1	1

TableII. - Facility Functional Capability Rating (3 = highest).

D. COMPUTER PROGRAM

The computer program (Appendix C) is designed to determine a facility's ability to support a given project through a simple linear relationship.

The project is initially analyzed to determine the degree of importance of each of the 26 functions in the completion of its T&E. Based on this analysis, weighting factors are assigned to each funtional category. These factors are then combined with the previously defined capability matrix to form the Linear Summation Equation. For example:

$$EFAC = FUNC(i) \times CFAC(i)$$

where EFAC is the effectiveness index of a facility, FUNC(i) is the weighting factor assigned to each functional category for the project, and CFAC(i) is the assessed capability of the facility in each of the 26 categories.

The optimal facility is then the facility with the highest effectiveness index. This index can, as previously noted, be subjected to a sensitivity analysis and be combined qualitatively with other factors such as cost, availability, etc.

The program also has the capability to do a sensitivity analysis. The weighting factors for each category may be varied by a constant ratio, CAT1, CAT2, etc. or a constant, VAR1, VAR2, etc. may be added to each individual weighting value.

E. SPECIFIC WEAPON SCENARIO

The weapon system to be tested is an air-to-air short-range, dog-fight type missile with passive homing capabilities(infra-red) and its launch vehicle an F-14/VFAX. The missile should be capable of being launched effectively within all points of the aircraft combat envelope against multiple targets. The missile has a 25 "g" turn capability, 10 miles maximum range, and Mach 4 speed. Targets should be representative of current Soviet combat aircraft (MIG 21, MIG 23, MIG 25, SU 9, Blinder).

1. Specific Requirements

The specific requirements of the test and evaluation are:

a. Base two fighter aircraft at the test site and provide hangar, fuel, oil, ground support equipment, etc., needed.

b. Provide housing, messing, transportation to support pilots, crew, and technicians. A total of 30 people.

c. Provide ordnance storage, handling, missile assembly and checkout for 20 missiles.

d. Provide threat simulation matching the targets mentioned above as closely as possible including multiple (2-4) target presentation.

e. Provide communication and command control of targets to present realistic maneuvering capabilities while guaranteeing the safety of launch vehicle crew.

f. Provide six channel telemetry for data collection and missile evaluation.

g. Provide an airborne photographic package capable of documenting missile shots and target maneuvering.

h. Provide limited technical services in the area of T&E support for this weapon system.

i. Provide data processing for test results.

j. Program expected to be completed six months from arrival on base.

2. <u>Task Categories</u>

In order to ensure consistency and establish a basis for sensitivity analysis, the 26 functions were grouped into 4 categories as follows:

a. <u>Mission Support</u>- those functional capabilities required to support a mission airborne weapon system T&E:

(1.) Aircraft Maintenance
(2.) Air Operations
(3.) Frequency Management
(4.) Geophysics
(5.) Operational Communication
(6.) Operational Control
(7.) Recovery

b. <u>Test Requirements</u>- those functional capabilities directly related to data collection and test conductance:

(1.) Command Control
(2.) Launching
(3.) Photography
(4.) Telemetry
(5.) Threat Simulation
(6.) Trajectory

c. Technical Support- those functional capabilities providing the technical "logistics" necessary to satisfy the T&E requirements:

(1.) Engineering Services
(2.) Internal Technical Services
(3.) Production Support
(4.) Software Support
(5.) Technical Services
(6.) Threat Assessment
(7.) Weapon System T&E

d. Base Support- those functional capabilities necessary to support routine military operations:

(1.) Administration and Management
(2.) Facilities/Utilities
(3.) Logistics
(4.) Military Community Services
(5.) Non-Operational Communication
(6.) Security

3. Weighting Factors

Depending on the weapon scenario selected, each of the functional capabilities has a different degree of importance and, therefore, has a different weighting in determining the overall effectiveness function for each facility. Although subjective, a logical and consistent approach to assigning weighting factors must be selected. A hierachy of importance was initially chosen as shown in Table III. The functional capabilities were ordered from least important to most important. In this instance both Internal Technical Services and Production Support were not required and were assigned a weighting of zero. Both Frequency Management and Management and Administration were considered next in importance. This process was continued down the line until the last and most important functional capability, Telemetry, was assigned the highest rating in

the hierachy.

This initial approach to assigning weighting factors was considered too restrictive. Each functional capability was assigned a discreet weighting factor, incrementally rated one unit more important than the preceding functional capability/capabilities. Depending on the decision maker's familiarity with the requirements of the scenario in question, he may feel that more than one unit degree of importance should be assigned to some capabilities. For this particular scenario it was felt that Command Control should be placed two increments over the preceding category and that Telemetry should be placed three units over Command Control. The results are presented in Table IV. In this particular case, the weighting factors now range from 0 to 15. Other personnel, more qualified to perform the weighting assignment, might feel comfortable with a more expanded scale. An organization such as NAVAIR 0-6 may be able to expand the scale significantly and thus provide for a more sensitive analysis of the data.

To provide a check on the adequacy of the weighting factors, the summation of weighting factors within each general category should be compared. For this scenario the results are as follows:

Test Requirement	60
Mission Support	40
Technical Support	30
Base Support	15

The weighting of each general category seemed to reflect its relative importance, so, for this particular scenario, no reassessment of the task categories total

weighting factor scores was considered neccssary. If it was felt that a reassessment was necessary, an iterative approach to reassigning weighting factors would be appropriate. A later section will address this approach in the sensitivity analysis.

It must be emphasized that these totals are directly related to the scenario depicted. A weapon system which greatly pushes the state-of-the-art might, for example, require a much higher value in Technical Support whereas a system involving a great number of people might require a higher total in Base Support.

4. Data Usage

Once the weighting factors were assigned, they were placed into the Linear Summation Equation from which the computer program outputted an ordered ranking of facilities by technical capabilities. Depending on the degree of confidence the decision maker places on his weighting assignment, he may want to input another set of weighting factors to ascertain if they will affect the results. This approach is addressed in the next section, the sensitivity analysis. If the new set of weighting factors affects the effectiveness ordering of the facilities, a reassessment of critcal factors is needed. If the order is unaffected, no further assessment for determining facilities' technical capabilties for the scenario is needed

FUNCTIONAL CAPABILITY	HIERARCHY
1. Internal Technical Services	0
Production Support	0
2. Frequency Management	1
Admisistrative and Management	1
3. Geophysics	2
Logistics	2
Non-Operational Communications	2
Engineering Services	2
4. Facilities/Utilities	3
Military Community Services	3
Operational Communications	3
5. Security	4
6. Recovery	5
7. Technical Services	6
Threat Assessment	6
Software Support	6
Aircraft Maintenance	6
8. Photography	7
Launching	7
9. Air Operations	8
10. Threat Simulation	9
11. Trajectory	10
Operational Control	10
Weapon Systems Test & Evaluation	10
12. Command Control	11
13. Telemetry	12

Table III. Hierarchy of Functional Capabilities

Rating of the 26 functional capabilities from least to most important in numerical order.

FUNCTIONAL CAPABILITY	WEIGHTING FACTORS
1. Trajectory	10
2. Telemetry	15
3. Command Control	12
4. Geophysics	2
5. Frequency Management	1
6. Photography	7
7. Launching	7
8. Recovery	5
9. Operational Communications	3
10. Operational Control	10
11. Threat Simulation	9
12. Technical Services	6
13. Internal Technical Services	0
14. Facilities/Utilities	3
15. Logistics	2
16. Air Operations	8
17. Military Community Services	3
18. Security	4
19. Non-Operational Communications	2
20. Administrative and Management	1
21. Threat Assessment	6
22. Software Support	6
23. Weapons Systems Test & Evaluation	10
24. Production Support	0
25. Engineering Services	3
26. Aircraft Maintenance	6

Table IV. Rating of Functional Capabilities

Finalized weighting factors used in dog fight missile scenario.

F. RESULTS AND SENSITIVITY ANALYSIS

A computer solution (Appendix C) was obtained for the example outlined using the stated values. In addition, initial sensitivity analysis was conducted by varying the category totals in such a manner as to keep the total point value of 145 constant. In all cases the Base Support category was held constant since it was felt its assigned value accurately depicted its importance. Changes were uniformly made on all elements within a category by inputing a ratio value into CAT1 through CAT4. Alteration of CAT1 through CAT4 investigated the sensitivity of total task categories' assigned values.

The first two cases show the effect of first decreasing Test Requirements by 16 percent and then increasing it by the same amount and evenly distributing the difference to Mission Support and Technical Support.

The next two cases depict the subtraction and then the addition of 20 percent (8 points) on Mission Support. Constant point value was maintained by evenly distributing the difference to Test Requirements and Technical Support.

The final two cases depict a similar subtraction and addition of 20 percent (6 points) on Technical Services.

In all cases above the relative ranking order remained constant, although the absolute difference in scores changed. ADTC closely challenged PMTC throughout the analysis for the number one position. A maximum difference in scores between the two facilities remained within three percent. The analysis shows that the values placed on category totals is not highly critical to end results throughout a reasonable range of values (16-20 percent).

Weighting factors within a task category were next changed independently by inputing an adjustment vector VAR(i). Throughout this analysis the total weighting factor of each task category was held constant. This analysis assumed a properly assigned category total but checks the sensitivity of assigned functional values within a category. In this example only the values with in the Test Requirement category were altered but similar analysis could be performed on the other three categories.

First, 5 points were subtracted from the Telemetry value and 1 point was added to each of the other five functional areas. It should be noted that this altered the functional hierarchy within the category by placing Telemetry subordinate to Command Control. Next, the category hierarchy was held constant by subtracting 1 point from Command Control and 3 points from Telemetry and adding 1 point to each of the other four areas. Finally, all areas within the category were uniformly assigned a value of 10 points.

Results indicate no change in the hierarchy of facilities' totals and little relative change between two consecutive facilities. In this scenario the task category total seems to be the dominated factor and little sensitivity is shown by manipulating each of the six variables within the Test Requirement category. Some facilities had the same values assigned in their capability vector in all effected functional area and thus showed no change in effectiveness total (eg. WSMR).

Thus it appears that once the faclitiess are accurately rated by functional capabilities, a Project Manager may assign his own weighting factors with confidence.

G. CONCLUSIONS

Suitable facility selection for adequate testing of weapon systems is an important prerequisite to acquiring combat functional weaponry. The present method of selection has drawbacks due to the subjectivity of the selection process; parameters somewhat irrelevant to proper selection frequently weigh heavily in the final selection. If the Navy is to improve its system acquisition process a more objective criterion must be implemented in the selection process.

This analysis has demonstated a rational method of objectively assessing the functional suitability of a facility for fulfilling the T&E requirements of a particular project. Time constraints and data limitations restricted the detail and objectivity of the analysis. In particular, the data source was based on the opinions of personnel attached to the same facility. This may inherently sway their impressions of competing facilities. The restrictive 0 - 3 rating scale employed eliminated the possibility of distinguishing between capabilities that were just above average and those that were totally superior to their competitors. The sensitivity analysis points out the importance of an expanded rating scale since weighting factor variations as large as 20 percent were ineffective in altering the overall ranking. It is believed that if more objectivity and an expanded rating scale were employed a differentiation in ranking would have resulted.

Follow-on study is recommended in this area since the analysis presents a straight forward method of ranking facilities through a weighted linear summation of 26 identifiable functional capabilities. To reduce bias, personnel at the NAVMAT or DoD level should conduct a survey of T&E facilities and rank the functional

capabilities on a scale of 0 - 10. If a facility expands its functional capabilities or for some other reason feels a higher rating is warranted the facility could appeal for a review of its ranking in the questionable areas. This ranking method could also provide useful feedback to facilities for determining their relative effectiveness and help identify areas needing improvement. When a Project Manager determines his T&E requirements a few computer cards could provide him with a list of the most qualified facilities.

This analysis does not pretend to propose the ultimate solution to the decision maker. Prior to final selection the Project Manager might have to weigh other less tangible considerations or parameters not yet identified by the analysis such as costs, time, and scheduling problems. However, this type of analysis reduces the difficulty of making the proper selection.

VII. CONCLUSIONS AND RECOMMENDATIONS

This chapter states what was accomplished by the research in view of the five objectives covered in the introduction. An attempt is also made, where applicable, to recommend improvements and to point out areas where additional research could be accomplished.

A. WEAPON SYSTEM ACQUISITION PROCESS

Research of current directives showed that T&E facility missions were not clearly defined and thus some overlap existed. NAVMATINST 5450.27 acknowledges the existence of overlap and encourages a limited amount of competition.

Although the Project Manager is granted a great amount of authority and responsibility by a Project Charter, few procedures seem to be clearly defined in the T&E facility selection process. Current directives seem to stimulate a buyer-seller relationship between the PM and the T&E facility.

Previous attempts, such as the establishement of TECO, have been unsuccessfull in providing for overall coordination of T&E within NAVAIR. The establishment of AIR-06 is an attempt to strengthen this coordination, but its effectiveness remains to be tested. There appears to be a problem of overlapping responsibilities in the control of resources inherent in the proposed system due to the double-hatting of 06T and 06R as pointed out in Chapter III.

B. FACILITY ORGANIZATION

In order for an organization to be effective it must be responsive and adaptable to its changing external

environment. This is particularly true of T&E facilities which are so intimately involved with a rapidly changing technology. The stagnation that has hampered operations at the Point Mugu complex must be set aside. The PMTC organization is structured to avoid stagnancy and to be reactive to its users' needs. However, an organization can only be as effective as the people working for it. Only time can determine if the personnel are willing to participate in its dynamic development.

C. EFFECTS OF FUNDING METHODS

The authors had the impression that the primary driving force behind a PM's selection of a T&E facility was cost. Research into the means by which activities receive their funds revealed that there are two major financial management techniques used by facilities. They are NIF and RMS. Additionally, the major T&E facilities, as specified in DODDIR 3200.11, have procedures and regulations governing their funding as a result of being MRTFB members. In general, then, a T&E facility is either under NIF or RMS for its financial management and receives its funds either from NIF or MRTFB/Institutional Funds.

NIF appears to be a more dynamic managerial method than RMS. NIF requires an activity to receive its operating funds through the sale of goods and services to customers. This causes several economic consequences: formation of a buyer-seller relationship, a need for customers, a need to ensure their satisfaction, and the formulation of a competitive environment. RMS, in contrast to NIF, only encourages a faciltiy to efficiently use its resources. An RMS activity is thus guaranteed of a user for its services and does not need to seek customers or ensure their satisfaction.

The difference in funding policy causes different charges to the user as discussed in Chapter IV.

D. PROJECT MANAGERS' PARTICIPATION

Respones from the questionnaire indicated that technical capabilitios an installation can offer for a project was the most important criterion used by decision makers in selecting a T&E facility. In contrast to the authors' original assumption, cost estimates were not number one but a distant third after technical capability and personnel expertise.

A Project Manager has considerable latitude in selecting a T&E facility and is not normally hampered by external constraints such as project urgency or higher authority prior selection. As was expected, he could be limited in his selection process by technical constraints to, possibly, one facility; and, approximately 45 percent of the PMs were. In addition to the latitude a PM enjoys during initial facility selection, he can, later on, alter the selection to another facility.

The process used by Project Managers to learn of an installation's capability was based heavily upon past experience and associates. Next in importance was the liaison offices established in Washington. The liaisons were used by a majority of the PMs, but the services could be improved. Reference 31 indicated that some liaison offices were better than others, which would have a direct influence on a Project Manager's perception of that facility. Publications were not considered a useful information source by the managers.

Project Managers do not desire a competitive

environment in T&E. They believe the cost of T&E would be reduced if competition among facilities were eliminated. This view is in conflict with NAVMATINST 5450.27 which expressed the opinion that limited competition is both necessary and good for T&E.

Responses from the questionnaire indicated a clear preference for NWC and the services it offers over other comparable facilities. This high degree of satisfaction with NWC was held by both Project Managers and Project Officers. It would be to the benifit of other facilities to investigate this finding further and determine the reasons behind the NWC number one ranking.

E. AN OBJECTIVE SELECTION PROCESS

The facility selection process developed in Chapter VI provides a systematic means by which a PM could determine which facility is most technically capable of handling his project. The 26 functional areas defined by PMTC personnel seem to exhaust the capabilities of a T&E facility in terms of services. Although it is recognized that the point totalization could be hand calculated, the computer program aids greatly in a sensitivity analysis of weighting factors.

There exists a need to make an objective determination of a facility's rating in each of the 26 areas and a method of updating it. This could be effectively accomplished by an organization such as AIR-06.

Additional research could be done in developing a more objective and easily understandable method of assigning project weighting factors. This might be done by a form which asks specific questions concerning the number of personnel to be based incident to a project etc. and

assigning point values accordingly.

It must be emphasized that the process is based on technical capability, only, and does not address itself to other factors such as cost which must be eventually considered.

Appendix A

PMR Financial Budget FY 74-81
(in million of dollars)

	74	75	76	7T	77
Operations					
Institutional	73.97	68.70	78.92	21.38	85.53
Direct Charges	8.0	20.55	19.53	5.19	20.76
Range Improvements					
Institutional	5.2	12.29	9.8	3.15	24.85
Others	3.67	2.54	11.64	1.21	8.41
TOTALS	90.84	104.08	119.89	30.93	139.55

	78	79	80	81
Operations				
Institutional	87.83	88.35	88.72	89.46
Direct Charges	20.76	20.76	20.76	20.76
Range Improvements				
Institutional	23.84	20.10	18.92	5.46
Others	8.09	4.08	1.08	0.0
TOTALS	140.51	133.29	129.48	115.68

PMR Direct Charges (Users' Funding)
(thousands of dollars)

<u>Navy</u>	<u>17,600</u>	<u>17,500</u>
RDT&E,N	300	300
O&M,N	3,300	3,400
NIF	14,000	13,800
<u>Other DoD</u>	<u>2,300</u>	<u>900</u>
RDT&E,AF	1,900	300
O&M,AF	320	525
O&M,A	80	75
<u>Non DoD</u>	<u>500</u>	<u>800</u>
AEC	0	440
NASA	500	360
<u>Non Federal</u>	<u>150</u>	<u>150</u>
TOTALS	20,550	19,350

Projected Total Operations

Range User	CY 75	CY 76	CY 77	CY 78
Navy	14,293	12,847	12,537	12,651
NASA	32	32	32	32
Civilian	0	0	0	0
DoD	12	12	12	12
AEC	77	76	76	76
USAF	942	896	885	837
Army	232	172	172	232
TOTALS	15,588	14,035	13,714	13,840

Naval Missile Center
(FY 75)

Customer	Work Requests (dollar value)
NAVAIR	$94,674,383
NAVSEA	$5,723,584
NAVELEC	$1,732,526
CNR	$252,065
Other Navy	$16,077,418
Marines	$211,349
Air Force	$3,389,420
Army	$1,139,714
NASA	$39,692
Other Govt. Dept.	$294,997
Private Parties	$23,630
ASO	$28,936
NAVILCO	$4,242,761
TOTALS	$127,830,475

APPENDIX B

TEST AND EVALUATION ASSESSMENT

Please enter the most appropriate number in the box at the right of each statement.

1.=Strongly Agree 2.=Agree 3.=No Opinion 4.=Disagree 5.=Strongly Disagree

1. More than one Test and Evaluation (T&E) facility was capable of providing the similiar services needed for my project. ☐

2. The technical constraints of my project limited selection to one T&E facility. ☐

3. The urgency of my project limited selection to one T&E facility. ☐

4. Current publications provide a useful source of information on the capabilities of T&E facilities. ☐

5. Other project managers provide a useful source of information on the capabilities of T&E facilities. ☐

6. Liaisons from T&E facilities provide a useful source of information on the capabilities of their facilities. ☐

7. A project manager's previous assignments provide a valuable source of information on the capabilities of T&E facilities. ☐

8. Staff assistance within a system command is useful in determining the capabilities of T&E facilities. ☐

9. There is a significant difference in costs to projects from T&E facilities offering comparable services. ☐

10. Different funding techniques (NIF/RMS,etc.) used by T&E facilities tend to mask the actual T&E cost of a project. ☐

Please enter the most appropriate number in the box at the right of each statement.

1.=<u>Strongly Agree</u> 2.=<u>Agree</u> 3.=<u>No Opinion</u> 4.=<u>Disagree</u> 5.=<u>Strongly Disagree</u>

11. Once a T&E facility has been chosen for a project a project manager has no latitude in altering the selection. ☐

NOTE: For the following 3 questions <u>comparable services</u> is meant to be those services which more than one T&E facility is capable of providing in support of a project.

12. As regards to facilities offering comparable services, there is a significant difference in the <u>information feedback</u> provided to a project manager to effectively monitor the progress of his project. ☐

13. There is a significant difference in the <u>technical expertise</u> of T&E facilities offering comparable services. ☐

14. As regards to facilities offering comparable services, there is a significant difference in the <u>ease of obtaining non-routine information</u> on the progress of a project. ☐

15. Funding level for T&E facilities' modernization is adequate to support my project needs. ☐

16. Rank each of the following factors with respect to its importance in the facility selection process.

    Cost Estimates ☐
    Personnel Expertise ☐
    Technical Capability ☐
    Logistics ☐
    Program Cooperation ☐
    Test Scheduling ☐
    Others (specify) ☐

    ____

Please enter the most appropriate number in the box at the right of each statement.

1.=Strongly Agree 2.=Agree 3.=No Opinion 4.=Disagree 5.=Strongly Disagree

17. Rank the following T&E facilities in their overall effectiveness in providing satisfactory services to project managers.

1. Most effective ------- 8. Least effective

A. Naval Weapon Center, China Lake ☐
B. Pacific Missile Test Center, Pt. Mugu ☐
C. Naval Air Test Center, Patuxent River ☐
D. Armament Development and Test Center, Eglin AFB ☐
E. White Sands Missile Range ☐
F. U.S. Army Yuma Proving Grounds ☐
G. Altantic Fleet Weapons Range ☐
H. Air Force Eastern Test Range, Patrick AFB ☐

18. Increased competition among T&E facilities would increase the effectiveness of services provided to project managers. ☐

19. Competition among T&E facilities should be eliminated in order to reduce the additional cost of overlapping capabilities. ☐

20. Selection of a contractor influences the selection of a T&E facility. ☐

21. DCP's are overly restrictive in their testing requirements and thus limit the project manager's selection to one T&E facility. ☐

22. Weapon systems T&E requirements are identified early enough to permit funding justification for facility modernization. ☐

When answering the following questions use the appropriate numerical response as indicated below.

1.= All 2.= Most 3.= Some 4.= Few 5.= None

23. T&E facilities are consistent in their method of assigning project priorities for completion. ☐

24. T&E facilities show a genuine interest in providing program support for successful completion of the project. ☐

25. Deficiencies noted by the P.M. in a project's progress are examined and corrected by the T&E facilities. ☐

26. T&E facilities capable of providing services for my project have shown eagerness for my project. ☐

27. T&E facilities actively participate in the selection process of weapon system test assignment. ☐

28. What is your rank/GS level? ☐

29. Highest level formal education achieved.

____Associate ____Baccalaureate ____Master(technical)

____Master(non-technical) ____Doctorate

30. Number of years involved in T&E assignments. ☐

31. Do you desire results of this questionnaire?

____YES ____NO

Mailing Address ______________________

____

____

form number

```
RUN NAME         T AND E ASSESSMENT
VARIABLE LIST    VAR001 TO VAR043
INPUT MEDIUM     CARD
SUBFILE LIST     PROJMANAGERS (23) VX04 (9) VX05 (11)
INPUT FORMAT     FIXED(40(F1.0),F2.0,F1.0,F2.0)
VAR LABELS       VAR001,DUPLICATE CAPABILITIES/
                 VAR002,TECHNICAL CONSTRAINTS/
                 VAR003,URGENCY CONSTRAINTS/
                 VAR004,FACILITY PUBLICATIONS/
                 VAR005,INFO FROM OTHER PMS/
                 VAR006,INFO FROM LIAISONS/
                 VAR007,PREVIOUS ASSIGNMENTS/
                 VAR008,STAFF ASSISTANCE/
                 VAR009,COST DIFFERENCE/
                 VAR010,FUNDING MASK EFFECTS/
                 VAR011,PM HAS NO LATITUDE/
                 VAR012,DIFFERENCE OF INFO FEEDBACK/
                 VAR013,DIFFERENCE OF TECH EXPERTISE/
                 VAR014,OBTAINING NONROUTINE INFO/
                 VAR015,FUNDING LEVEL ADEQUACY/
                 VAR016,COST ESTIMATE RANKING/
                 VAR017,PERSONNEL EXPERTISE RANKING/
                 VAR018,TECH CAPABILITY RANKING/
                 VAR019,LOGISTICS RANKING/
                 VAR020,PROGRAM COOPERATION RANKING/
                 VAR021,TEST SCHEDULING RANKING/
                 VAR022,OTHERS RANKING/
                 VAR023,EFFECTIVENESS NWC/
                 VAR024,EFFECTIVENESS PMTC/
                 VAR025,EFFECTIVENESS NATC/
                 VAR026,EFFECTIVENESS EGLIN/
                 VAR027,EFFECTIVENESS WSMR/
                 VAR028,EFFECTIVENESS YUMA/
                 VAR029,EFFECTIVENESS AFWR/
                 VAR030,EFFECTIVENESS PATRICK AFB/
                 VAR031,INCREASE COMPETION/
                 VAR032,ELIMINATE COMPETITION/
                 VAR033,CONTRACTOR INFLUENCES/
                 VAR034,DCP LIMITS TO 1 FACILITY/
                 VAR035,EARLY REQUIREMENTS IDENTIFICATION/
                 VAR036,ASSIGNING PROJECT PRIORITIES/
                 VAR037,FACILITY PROGRAM SUPPORT/
                 VAR038,DEFICIENCY CORRECTION/
                 VAR039,FACILITY EAGERNESS/
                 VAR040,FACILITY PARTICIPATION/
                 VAR041,RANK/
                 VAR042,EDUCATION/
                 VAR043,YEARS EXPERIENCE IN T&E/
```

```
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                      (02)AGREE
                      (03)NO OPINION
                      (04)DISAGREE
                      (05)STRONGLY DISAGREE/
                VAR002 TO VAR016 (1) STRONGL AGREE
                      (02)AGREE
                      (03)NO OPINION
                      (04)DISAGREE
                      (05)STRONGLY DISAGREE/
                VAR016 TO VAR030 (1) 1
                      (02)2
                      (03)3
                      (04)4
                      (05)5
                      (06)6
                      (07)7
                      (08)8/
                VAR031 TO VAR035 (1) STRONGLY AGREE
                      (02)AGREE
                      (03)NO OPINION
                      (04)DISAGREE
                      (05)STRONGLY DISAGREE/
                VAR036 TO VAR040 (1) ALL
                      (02)MOST
                      (03)SOME
                      (04)FEW
                      (05)NONE/
                VAR041(01)0-1
                      (02)0-2
                      (03)0-3
                      (04)0-4
                      (05)0-5
                      (06)0-6
                      (07)0-7
                      (08)0-8
                      (09)0-9
                      (10)GS-10
                      (11)GS-11
                      (12)GS-12
                      (13)GS-13
                      (14)GS-14
                      (15)GS-15
                      (16)GS-16/
                VAR042(01)ASSOCIATE
                      (02)BACCALAUREATE
                      (03)MASTER TECH
                      (04)MASTER NON-TECH
```

```
                 (05)DOCTORATE
                 (06)DUAL MASTER/
           VAR043(01)01
                 (02)02
                 (03)03
                 (04)04
                 (05)05
                 (06)06
                 (07)07
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                 (22)22
                 (23)23
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                 (27)27
                 (28)28
                 (29)29
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FREQUENCIES    GENERAL=ALL
OPTIONS        3,8,9
STATISTICS     1,3
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522525422222113421536034152678445454343306204     026
444342443443333621435000000000424432111106331     020
233323323343443431625000000000244330233006331     019
244332243342113321654012000000244420031306331     024
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423223133242233421653012300000424344323306205      34
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FINISH
```

APPENDIX C

```
C                    T&E FACILITY SELECTION PROGRAM
C
C     THIS PROGRAM DETERMINES THE ABILITY OF A FACILITY TO SUPPORT
C     A SPECIFIED PROJECT BASED ON A PRE-DETERMINED CAPABILITY
C     EFFECTIVENESS MATRIX AND A WEIGHTING FACTOR VECTOR DETERMINED
C     BY A PROJECT'S REQUIREMENTS.
C
C     DEFINITIONS:
C        EFFECTIVENESS VECTORS-A FIXED INPUT DETERMINED FROM A FACILITY
C         FUNCTIONAL CAPABILITY RATING OF 26 FUNCTIONAL AREAS.
C          CPMTC-POINT MUGU
C          CAFWR-ATLANTIC FLEET WEAPON RANGE
C          CADTC-EGLIN AFB
C          CNATC-PATUXENT RIVER
C          CNWC-CHINA LAKE
C          CYUMA-YUMA
C          CWSMR-WHITE SANDS
C
C        FUNC(I)-SCENARIO-DEPENDENT INPUT WEIGHTING FACTOR VECTOR
C          CONTAINING THE USER-ASSIGNED VALUES FOR EACH OF THE 26
C          FUNCTIONS.
C        SFUNC(I)-COPY OF FUNC(I) TO PREVENT DESTRUCTION DURING
C          SENSITIVITY ANALYSIS
C        CT-SENSITIVITY ANALYSIS FLAG. IF 0, NO RATIO VALUES ARE INPUT
C        VR-SENSITIVITY ANALYSIS FLAG. IF 0, VAR(I) VECTOR IS NOT INPUT
C
C        VAR(I)-AN INPUT VECTOR ADDED TO FUNC(I) DURING SENSITIVITY
C          ANALYSIS WHICH CHANGES THE WEIGHTING FACTORS INDEPENDENTLY.
C          VALUES ARE DETERMINED BY USERS NEEDS TO INVESTIGATE
C          SENSITIVITY OF ASSIGNED WEIGHTING FACTORS.
C
C        CATEGORY SENSITIVITY ADJUSTMENTS (CAT1 THROUGH CAT4)-AN USER
C          INPUT VALUE WHICH PROPORTIONALLY ALTERS ALL WEIGHTING
C          FACTORS WITHIN A TASK CATEGORY DURING SENSITIVITY ANALYSIS.
C          CAT1-MISSION SUPPORT
C          CAT2-TEST REQUIREMENT
C          CAT3-TECHNICAL SUPPORT
C          CAT4-BASE SUPPORT
C
C        NS-SENSITIVITY ANALYSIS FLAG. 0 INDICATES NO SENSITIVITY
C          ANALYSIS TO BE PERFORMED AND IGNORES VAR(I) AND CAT VALUES.
C
C        EFFECTIVENESS TOTALS (EG. EPMTC):
C          AN OUTPUT VALUE REPRESENTING A FACILITY'S TOTAL TECHNICAL
C          CAPABILITY SCORE FOR A GIVEN SCENARIO.
C
C***********************************************************************
```

```
      DIMENSION CPMTC(26),CAFWR(26),CADTC(26),CNATC(26),CNWC(26)
      DIMENSION CYUMA(26),CWSMR(26),FUNC(26)
      DIMENSION VAR(26)
      DIMENSION SFUNC(26)
      DATA EPMTC/0./,EAFWR/0./,EADTC/0./,ENATC/0./,ENWC/0./,EYUMA/0./
      DATA EWSMR/0./
      DATA NS/1/
      DATA CPMTC/4*2.,2*3.,2.,2*3.,2*2.,3.,2.,3.,2*2.,3.,8*2.,3./
      DATA CAFWR/2.,1.,3.,1.,4*2.,3*1.,2.,1.,0.,2.,5*1.,3*2.,2*1.,2./
      DATA CADTC/2*3.,7*2.,3.,2*2.,2*3.,3*2.,3.,2.,3.,3*2.,3.,2.,1./
      DATA CNATC/2*3.,1.,2.,2*1.,      2.,2*0.,2.,3.,0.,1.,5*2.,2*1.,4*2.
     1,3.,2./
      DATA CNWC/2*2.,2*1.,2*2.,2*1.,2*2.,3*1.,3.,2*2.,1.,2.,1.,6*2.,1./
      DATA CYUMA/14*1.,2.,2*0.,1.,0.,1.,5*2.,1./
      DATA CWSMR/1.,5*2.,1.,8*2.,1.,0.,2*1.,7*2./
      DATA CAT1/1.0/,CAT2/1.0/,CAT3/1.0/,CAT4/1.0/
      DATA VAR/26*0./
      DATA FUNC/6.0,8.0,6.0,2.0,3.0,10.,5.0,12.,7.0,7.0,15.,9.0,10.,2.0,
     10.0,0.0,6.0,6.0,6.0,10.,1.0,3.0,2.0,3.0,2.0,4.0/
      DATA CT/0./
      DATA VR/1./
      DO 50 I=1,26
      SFUNC(I)=FUNC(I)
   50 CONTINUE
   99 IF(NS.EQ.0) GO TO 5
C
C    SENSITIVITY ANALYSIS
C
C
C
C     ADJUST VALUES FOR MISSION SUPPORT
C
      DO 1 I=1,7
      FUNC(I)=CAT1*FUNC(I)+VAR(I)
    1 CONTINUE
C
C     ADJUST VALUES FOR TEST REQUIREMENTS
C
      DO 2 I=8,13
      FUNC(I)=CAT2*FUNC(I)+VAR(I)
    2 CONTINUE
C
C     ADJUST VALUES FOR TECHNICAL SUPPORT
C
      DO 3 I=14,20
      FUNC(I)=CAT3*FUNC(I)+VAR(I)
    3 CONTINUE
C
C     ADJUST VALUES FOR BASE SUPPORT
```

```
C
      DO 4 I=21,26
      FUNC(I)=CAT4*FUNC(I)+VAR(I)
  4   CONTINUE
C
C
  5   CONTINUE
      DO 10 I=1,26
      EPMTC=CPMTC(I)*FUNC(I)+EPMTC
      EAFWR=CAFWR(I)*FUNC(I)+EAFWR
      EADTC=CADTC(I)*FUNC(I)+EADTC
      ENATC=CNATC(I)*FUNC(I)+ENATC
      ENWC=CNWC(I)*FUNC(I)+ENWC
      EYUMA=CYUMA(I)*FUNC(I)+EYUMA
      EWSMR=CWSMR(I)*FUNC(I)+EWSMR
 10   CONTINUE
      WRITE(6,400)
      WRITE(6,100)
100   FORMAT(1X,T20,'MEASURES OF EFFECTIVENESS',//)
      WRITE(6,200)
200   FORMAT(1X,T15,'PMTC',T25,'AFWR',T35,'ADTC',T45,'NATC',T55,'NWC ',T
     165,'YUMA',T75,'WSMR',/)
      WRITE(6,300) EPMTC,EAFWR,EADTC,ENATC,ENWC,EYUMA,EWSMR
300   FORMAT(1X,8X,7(F10.2),/)
      WRITE(6,400)
400   FORMAT(1X,T10,'*******************************************
     1********************',//)
      IF(CT.EQ.0.) GO TO 20
      READ(5,500) CAT1,CAT2,CAT3,CAT4
500   FORMAT(4F10.7)
   20 CONTINUE
      IF(VR.EQ.0.) GO TO 30
      READ(5,600)(VAR(I), I=1,26)
600   FORMAT(26F3.1)
      WRITE(6,601) (VAR(I), I=1,26)
601   FORMAT(1X,26F4.1,/)
30    CONTINUE
      IF(CT.EQ.0..AND.VR.EQ.0.) GO TO 15
      EPMTC=0.
      EAFWR=0.
      EADTC=0.
      ENATC=0.
      ENWC=0.
      EYUMA=0.
      EWSMR=0.
      DO 60 I=1,26
      FUNC(I)=SFUNC(I)
   60 CONTINUE
```

```
      GO TO 99
 15   STOP
      END
C     DATA
C
                      TASK CATEGORY ANALYSIS
0.8333333  1.125    1.166667   1.0
1.166667  .875      .8333333   1.0
1.0666667  .8       1.133333   1.0
.933333   1.2       .86666667  1.0
1.05       1.075    .8         1.0
 .95      .925      1.2      1.0
                     FUNCTIONAL VALUE ANALYSIS
                  1. 1. 1.-5. 1. 1.
                 -1. 1. 1.-3. 1. 1.
                 -2. 3. 3.-5. 1.
```

ORIGINAL

PMTC	AFWR	ADTC	NATC	NWC	YUMA	WSMR
343.00	210.00	338.00	220.00	217.00	144.00	255.00

TASK CATEGORY ANALYSIS

	PMTC	AFWR	ADTC	VATC	NWC	YUMA	WSMR
TEST REQ. -16%	357.33	212.12	352.46	223.46	223.42	147.83	264.50
TEST REQ +16%	328.67	207.87	323.54	216.54	210.58	140.17	245.50
MISS. SUP -20%	328.67	202.60	327.27	217.07	213.33	137.07	240.40
MISS. SUP +20%	357.33	217.40	348.73	222.93	220.67	150.93	269.60
TECH. SERV. -20%	345.15	214.27	337.37	220.12	215.90	146.90	260.25
TECH. SERV. +20%	340.85	205.72	338.62	219.87	218.10	141.10	249.75

FUNCTIONAL VALUE ANALYSIS

	PMTC	AFWR	ADTC	VATC	NWC	YUMA	WSMR
TELEMETRY -5	346.00	212.00	340.00	208.00	219.00	144.00	255.00
CONSTANT HEIRARCHY	344.00	210.00	340.00	214.00	219.00	144.00	255.00
UNIFORM VALUE	345.00	209.00	341.00	211.00	223.00	144.00	255.00

TABLE C1. RESULTS AND SENSITIVITY ANALYSIS

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